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WE advertise to receive subscriptions for THE ELECTRICAL WORLD and *Industrial America* together, for one year, for $4; while the single prices of the papers make $5. Several correspondents who have subscribed within the last week or two for THE ELECTRICAL WORLD and paid $3, ask whether they can get *Industrial America* until the close of their subscription for the other journal, if they remit $1 more. In reply, we wish to say that we will book them for both papers on receipt of the additional $1.

REFERRING to the proposal to put the Rev. Dr. Talmage "on tap," telephonically, Mr. J. D. Milier, connected with the National Telephone Company, in Scotland, says that churches at Birmingham and Bradford have been in connection with the local exchanges for two years. The first connection of a church with an exchange in Scotland was made by himself in June, 1882, when he joined up the George Square Congregational Church at Greenock, since when sermons have been "served hot" to a number of private residences in Greenock, and to several in Glasgow as well—a distance of over 22 miles.

IT is said that the lower cable rates have kept the Commercial Cable Company very busy. Many people want to know whether the lowest rate has yet been made. The tendency of ordinary cable charges has been steadily downward, from $5 per word in 1866 to $2.50 in 1867, then $1 in 1869, and since then, with only a few upward fluctuations, to forty cents at the present time. There is no special reason why the charge should be 40 cents instead of 20, seeing how fierce the competition is; and, judging by the bellicose way in which Mr. Cyrus Field talks, a 10 cent rate may be expected at no very distant date.

WE publish to-day the last of Mr. Wm. Maver, Jr.'s, interesting and valuable articles on overhead copper wire. The subject is one of pre-eminent importance at the present time, and we are glad thus to lay before our readers many new facts and suggestions in connection with it. It is but fitting to make note of the willingness with which the Baltimore & Ohio Company has allowed its own experience in this matter to be made public. The disposition of large companies is, generally, to keep back such information, and to leave others to find out what they can at their own expense. A departure of this kind from the customary attitude and procedure is highly commendable.

THE "bucket shop" nuisance is not confined to this country. It has to be dealt with in London as well as in New York and Chicago, and it is now reported that a committee of the London Stock Exchange has the subject under consideration. Our English contemporary, the *Electrician*, says: "It seems not unlikely that the 'tape system,' as it is called, will be excluded from the hallowed precincts of the Exchange; that is, supposing the committee are in earnest about the matter, and the outside gambling fraternity does not prove too powerful." There's the rub. The "bucket shops" are not without strong backers in the very exchanges that wish to extirpate the small fry of the brokerage profession.

THE Baltimore & Ohio Telegraph Company professes a strong faith in its own ability to live and prosper on the present low rates. Mr. Gould is not less complacent, outwardly, and says that the subject of a reduced dividend for the Western Union Company has not been considered. He thinks that the company can pay 6 per cent. still, by meeting lower earnings with reduced expenses. Time will show. Meanwhile, the Western Union Company has, out West, thrown aside the Mutual Union mask, and shown itself in the fight. It has met the B. & O. "cut," not alone by a Mutual Union "cut," but by reducing its own rates between Indianapolis, Cincinnati and Chicago. This open fight may soon extend all along the line.

OUR English cousins are very persistent in their endeavors to employ the electric light on the railways. We have noted recently the improvements made in this respect, and have pointed out the differences between the two systems: that in which a dynamo and driving engine are carried on the locomotive, whose boiler furnishes the steam, and that in which accumulators are used, with a dynamo driven by means of the motion of the car itself. Both plans have warm advocates and active exponents in England. Here very little—next to nothing—is being done in the matter. The latest instance there is the lighting of two trains on the South Eastern Railway, between London and Maidstone, with incandescent lamps. The system employed is not described, but the trial appears to have been very successful.

THE electric light is deservedly popular with the proprietors of large dry goods stores. A magnificent store in Brooklyn, just finished, has been fitted up for Excelsior (Hochhausen) arc lamps on a liberal scale, and we note that Mr. Whiteley, the "universal provider" of London, has purchased for his Westbourne Grove store the 1,000-incandescent light Ferranti machine, which took the gold medal at the late Health Exhibition. Mr. Whiteley already has a Ferranti machine running 350 lamps. The recommendations of electricity for store lighting are not a few. Goods can be displayed and seen to advantage; exposed stock is not liable to spoil, as with gas; and the air is neither heated nor vitiated. At first the storekeepers thought only of the electric light as a new form of advertising. They have now a realizing sense of its many other good qualities.

PERHAPS one ought not to expect great exactitude in the statements of the Paris newspapers, but having noted the following item in *Galignani's Messenger*, we feel compelled to ask for a correction or an explanation: "The funeral of M. Louis Auguste Morse, *the well-known inventor of the telegraphic apparatus which bears his name*, has just taken place in Paris. M. Morse was born at Liège, Belgium, but for some years past has taken up his residence in the French capital and occupied an apartment in the Rue Solférino, where he died from apoplexy a few days ago. The deceased was fifty-eight years of age." The Paris *Figaro* also remarks: "There was buried a few days ago, and no journal has, we believe, yet mentioned it, a man who has rendered very great service to science by the practical discoveries to which he devoted his life and his intelligence, M. Louis Auguste Morse, the inventor of the system of the telegraphic apparatus bearing his name." This is equally mystifying. What does it all mean? Has any one imposed on the editors of these papers?

IT is hoped that the plant will be ready during this month for the experiments in the electrical transmission of power from Creil to Paris. The circuit is more than 70 miles in length, and about 47 miles of it will be insulated. The current to be generated for transmission is 20 ampères at 7,500 volts, or 200 horse-power. The details of the installation were given by us on Oct. 25, and in later notes. The work is undertaken by a powerful syndicate with the object of realizing the theories of Marcel Deprez, and it will be watched with great interest by electricians everywhere.

IT has for some time been our wish to have the West more fully represented in the columns of THE ELECTRICAL WORLD, and we now take much pleasure in informing our numerous friends and readers in that section of the country that we have opened a branch office, 22 Borden Block, 99 Randolph street, Chicago. This office is under the charge of Mr. W. A. Kreidler, formerly of the correspondence department of the Western Electric Company at Chicago. Mr. Kreidler will be happy to perform any service within his power for our friends, and will be glad to see any of them at the above address. Items of news, advertisements, etc., intrusted to him will receive due and prompt attention.

MR. W. H. PREECE has at last been roused to indignation by the attacks made on him, chiefly by his own countrymen, for the share he has taken in trying to secure the general adoption of the watt. We publish a letter from him in which he hits out vigorously from the shoulder, and makes a very good defense. As regards ourselves, we wish simply to say that in quoting the opinions on both sides—not the abuse—we have only carried out our rule of ventilating a subject as much as possible, and of being impartial. We would add, too, that no one was heard by American electricians last year with more pleasure than Mr. Preece. The common feeling was one of admiration for the ease clearness, force and soundness of his speeches.

NOTE is made elsewhere in this issue of the formation of a new company for long-distance telephony under the Bell patents. It has our best wishes for its success. The outlook is that this country will be the first to enjoy the extension of the telephonic art in this respect. But there will be a great many points to settle before we get long-distance telephony "for the million." Several thoughtful men have been at work on the problems presented for solution. One of the first facts to recognize is the shortness of the time, daily, in which long-distance telephone service can practically be operative—seven or eight hours at the most; and the next fact is that each conversation must be allowed at least five minutes. Take, for instance, a line between New York and Boston. What would have to be the charge to the public, on a basis of only 85 to 100 messages per day over the telephone wire between the two cities? This may seem a crude way of getting at the difficulties of the case, but it is forcible. On the other hand, while not offering serious competition to ordinary telegraph service, long distance telephony may pay at high rates in view of the fact that it gives *instant communication* between the parties at each end of the line; and it may also pay very well as special service similar to that of leased telegraph lines.

AS we happen to be speaking of long-distance telephony, the present opportunity is a good one for exposing the inaccuracy of a report that has met us almost daily, in all kinds of papers for months past. The report states circumstantially that the engineers of the International Bell Telephone Company have successfully carried on conversations between St. Petersburg and Bologne (or Bologna according to some), a distance of 2,465 miles. The actual facts of the case were, however, given by us last July, in the language of Mr. Crawford, chief engineer of the company. The line experimented upon was from St. Petersburg to Bologoe, a distance of 302 versts, or about 200 miles. The tests were, very successful, but there was nothing extraordinary in the achievement. Unfortunately some English contemporary of ours got the item also, at second hand, out of the Continental papers, and in doing so, left out the mileage and made Bologoe into Bologne. Then somebody statistically inclined made the distance from St. Petersburg to Bologna 2,465 miles. Then *Chambers' Journal* worked up the item, and then hundreds of papers swallowed it whole. We are sorry for them.

REVIEWS OF NEW BOOKS.

THE QUADRUPLEX, by Wm. Maver, Jr., and Minor M. Davis; with chapters on the dynamo-electric machine in relation to the quadruplex, the practical working of the quadruplexes, telegraph repeaters, and the Wheatstone automatic telegraph, by Wm. Maver, Jr. New York: W. J. Johnston, publisher. 1885. $1.50.

It is very evident that the authors of this work had in mind constantly the fact which they have announced in the preface—namely, that they were writing a description of systems and instruments with which operators have much to do, and that they were writing the description for operators.

The quadruplex has been written of before, more than once, but as a rule the descriptions have been exceedingly brief and superficial. It is true that in one or two instances it has been treated at some length, but even then the aim seems to have been to give a description which would be intelligible to electricians only, and frequently a very simple matter is made mysterious by a multitude of plus and minus signs. In many cases ambitious operators, desirous of acquiring a theoretical knowledge of a system with which they come in daily contact, have gone to those pages for information, and have returned uninformed. That such is the case none knew better than the authors of "The Quadruplex," and knowing just what operators wanted in this respect, and the style in which they wanted it, the writers set about to fill that want.

That they were successful was abundantly evinced by the welcome which the article received on its first appearance in the pages of *The Operator*.

The method adopted by Messrs. Maver and Davis in their work is simple and unaffected. They begin at the beginning and are not satisfied with merely stating a fact. They there and then explain why it is so. Wherever it is necessary to refer to a law of electricity, they speak in language that must be plain to the dullest. When it is possible that a point might still be obscure, they have searched for a familiar analogy with which to illustrate it. An example of this is seen in the description of the polar duplex, page 38.

Many writers are doubtless often deterred from entering fully into the explanation of what is to them a simple matter, lest they should be accused of verbosity, forgetting that to the man who is entirely unacquainted with this presumably simple matter no explanation can be too complete. The man who is already acquainted with the matter in question does not even require a brief explanation of it. It is plain that Messrs. Maver and Davis were also aware of these facts, for, so far as we have observed, no point has been slurred.

What we have said concerning the portion of this book that is devoted to the quadruplex is also true of the chapters exclusively from Mr. Maver's pen; namely, those on the dynamo-electric machine in its relation to the quadruplex; the practical working of the quadruplex, etc.

This is the first time that a full and illustrated description of Mr. S. D. Field's dynamo quadruplex system has been published, and it is only just to Mr. Maver to say that he has happily succeeded in putting into plain and every day language a description of a subject which in the hand of some writers would have been to the uninitiated a labyrinth of algebraic symbols.

In his "Practical Working of the Quadruplex," also, there can be no mistaking the fact that the writer is in earnest in his purpose to aid those who have not had the same opportunities as himself to become familiar with the vexatious troubles to which all multiplex systems are prone; and while it is more than likely that Mr. Maver has not told all he knows about those troubles, he has certainly told enough to amply compensate the parties for whose benefit he writes for the outlay in procuring this book, were there not another chapter in it.

The diagrams in this work are a special feature of it, and it is plain that they have been designed with a view to placing the various connections and circuits in the plainest possible light. We are glad to notice in this relation that in almost every instance the diagrams are placed in such a position with regard to the printed descriptions that they may be readily referred to.

Throughout the book, as already said, there are many allusions to and explanations of laws of electricity, and it may be said, without at all exceeding the truth, that a beginner who will carefully study the chapters contained therein will find himself not only equipped with a theoretical and in a measure a practical knowledge of the quadruplex, repeaters, etc., but also with a very fair knowledge of the rudiments of electricity.

The book is got up in the usual neat and substantial style peculiar to publications emanating from the above establishment. The type is large and legible, and as to the binding and general outside appearance of the book it is only necessary to say that in this respect it is a companion book to Swift's "Practical Telegrapher." The work should be in the hands of every operator.

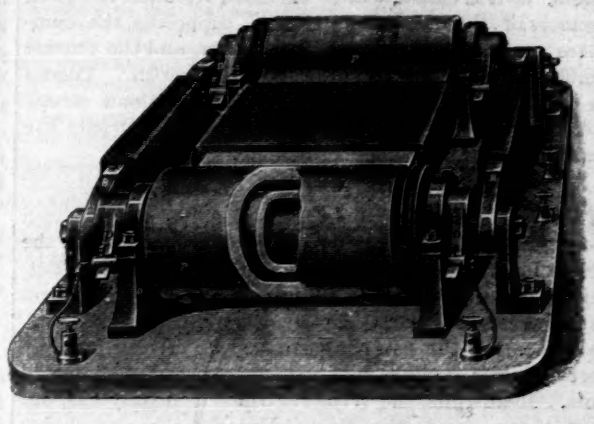
The Hocking Valley Troubles.—A dispatch of Jan. 5 from Columbus, O.: "The striking miners had control of the wire in Hocking Valley Saturday night, and issued a false order for the running of a special train from Butchel to Straitsville, which, if it had not been discovered, might have resulted in great damage and probable loss of life, as a collision would have occurred if it had run on the order. Reports are that the wire is being tampered with again."

A Crane Worked by Electricity.

The *Bulletin* of the Compagnie Internationale des Téléphones contains a description of a twenty-ton crane that for two months past has been successfully worked in the foundry of M. Farcot, at Saint-Ouen, France, the motion being caused by the electric current. The generating machine, placed over 100 yards from the crane, gives a current at the terminals of about 350 volts at 18 ampères when making 1,550 revolutions a minute. The motor attached to the crane makes 1,000 revolutions a minute, and exerts a power of four horses at its shaft. A special rheostat permits of progressively introducing resistances which may amount to 60 ohms, and, consequently, of varying at will the speed of lift. No change has been made in the parts of the crane, which may be worked by hand when the steam engine is not running. A Mégy brake, made by Sautter et Lemonnier, would prevent the load from falling in the event of any accidental derangement. In lifting heavy castings from their molds, a vacuum is caused, owing to which the total or partial atmospheric pressure is added to their weight, which might thus exceed the power of the crane. In such a case, the circuit is interrupted automatically, thus warning the engine man. By the aid of the electric current one man now works the crane instead of ten as formerly.

The Delafield Pipe Dynamo.

At the recent Electrical Exhibition at Philadelphia there was shown a form of dynamo for electro-plating purposes which presented some novel features, its simplicity being one of its chief merits. The principle involved is analogous to that of Arago's disc, but in the Delafield dynamo the disc is replaced by a copper pipe. This latter is surrounded by the hollow pole-piece of one of the magnets *P P'*, while the pole-pieces of the other magnets *B B B* are in the shape of solid cylinders which pass directly through the copper tube. Thus by exciting the magnets so that the inner cylinder shall have south and the outer hollow one north polarity, we obtain an intense field in which to revolve the copper pipe forming the armature. The field coils are wound in shunt, and as the pipe revolves



THE DELAFIELD PIPE DYNAMO.

in a field of uniform polarity no commutator is required, the current being collected by brushes *D D D* pressing directly on the ends of the armature. The electromotive force, as the machine is run, is said to be 1.2 volts, and the resistance of the copper pipes, constituting the armatures, .000048 ohm.

Electrical Development in America.

At the last meeting of the English Society of Telegraph Engineers and Electricians, Mr. W. H. Preece read a paper on "Electricity in America in 1884." It appears to have been not less interesting than his review of electric lighting progress in this country, recently published. He began by describing the doings of last year at Montreal and Philadelphia, and stated that Prof. Forbes would read a paper before the Society on the Electrical Exhibition.

When the author visited America in 1877, he found a great deal to learn and take advantage of; but since that year he found that practically no advance had been made, whereas we in England had rapidly advanced. As regards the material progress, he would mention that in 1877 the mileage of Western Union wire in America was 200,000, whereas in 1884 it was 433,726. The number of messages had increased from 28,000,000 to 48,000,000; the number of offices from 11,660 to 13,600, while the capital invested had increased from $40,000,000 to $80,000,000. The Western Union Company had, in fact, made great material, but no scientific progress. He should state, however, that a novelty in the shape of the Delany multiplex had been experimented with, and gave promise of good results. This apparatus would be shown at the coming Inventions Exhibition, and would be also probably tried on the post-office wires. Although we in England had not hesitated to adopt foreign systems, yet the reverse was not the case except as regards the Wheatstone instruments, which were coming into extended use in the States. The telephone industry had passed through an awkward phase, determined attempts having been made to upset the Bell patents. In the author's opinion, the pretexts upon which the attempts were founded were of the flimsiest possible description. The extent to which the telephone was in use in the United States could hardly be imagined in this country. This extensive use existed in spite of the restrictions, which were far greater than they were in this country. One company, he might mention, was taxed to the extent of 75 per cent. of its receipts. The reason why the telephone was so extensively used was because it was a vital necessity for business, partly in consequence of the excessive heat preventing exertion to a great extent. The extensive employment of electric signals for domestic purposes was in a great measure due to the high rate of wages, rendering it cheapest to have ordinary errands done by an organized corps of messengers called by signal when required. The charges for telephonic communication were higher than in this country; the annual charge for the "law" system (a system employed by lawyers) being £44; the ordinary charge was £35. In Chicago it was £26, and in Boston and Philadelphia £25. Buffalo, exceptionally, had a charge by results, the rate being 6, 5 and 4 cents per call, according to the guaranteed minimum number of calls (500, 1,000 and over 1,000, respectively). The instruments used are no better, and in many cases are worse, than those used in England. The exchange system was, however, infinitely better carried on, partly because the public do their best to assist the companies in the matter, and are very forbearing. Liverpool, in this country, however, compared favorably with the American service. At Milwaukee the maximum time of putting through was four seconds only. There were in use 97,400 telephone circuits, worked by 90,000 miles of wire, while 517,000 instruments had been manufactured. In New York there were 10,600 subscribers, whereas there were but 11,000 in the whole of England. The electric lighting system was making great progress, but the general use of high tension currents, with overhead wires mixed up with other circuits, was most objectionable, and several fires were clearly traced to this arrangement being in use. The appearance of the wires were also most unsightly. The use of cut-outs, which worked when a current exceeding 1 ampère passed through a telephone line, was becoming general, and many accidents were avoided by their use. Edison had undoubtedly solved the problem of the centralization of electric lighting. Among other workers, Edward Weston deserved mention as having brought electric lighting to a great pitch of perfection. About 90,000 arc lamps were now in use in the States.

Cheap Telegraphy.

Discussing the reduction of rates to "popular prices" to be inaugurated in England during 1885, *The Electrician*, of London, says: In view of the greater influx of messages consequent upon the adoption of the cheaper rate of telegraphing in August next, the electrical department of the post-office has been and is now adding and extending a large number of new wires throughout the metropolis and the provinces to meet the expected increase in telegraphic work. In London, notably in the Paddington district along the Uxbridge road and other main thoroughfares, the wires have been placed in iron piping and laid underground, it being the intention of the authorities to do away, as far as practically can be done, with all overhead wires, and the pneumatic tubing now so successfully carried on between the London central telegraph office and the city offices (when removed from the upper galleries of central office to the ground floor) will, it is anticipated, be extended to the various district offices throughout the metropolis, thus enabling the department to utilize the wires in present use of these offices, about 12 in all, for another purpose.

New Form of Engine Governor.

A Birmingham firm has recently patented an engine governor for engines working dynamos and machinery requiring delicate adjustment of speed, or where the load is likely to be quickly varied. The following statement is taken from documents used by the firm:

The action of the pendulums effects the opening and closing of an equilibrium valve. The spring acts as a counterbalance so as to allow increased velocity to the governor balls and is brought into tension when acted upon. It is inclosed in a steel chamber, and to this chamber the arms are connected by thin steel strips which, when working, bend round the arcs forged on the top end of the pendulums. In this way the spindle, which is connected by the coupling to the lever, is raised and lowered, a small link carrying the movement through the lever to the spindle of the equilibrium valve, which is hung eccentrically instead of concentrically, and when open will allow of the passage of the steam along the greater part of its circumference and on both sides. A very slight movement of the valve is sufficient to govern the engine. As the valve is in equilibrium there is no fear of its sticking, and the cover can easily be removed to admit of examination. On the bearing surface of the revolving part of the governor a steel ring runs in a bath of oil, a small chamber being cast on the top of the frame for this purpose. The part of the apparatus in which the pulley is mounted can be turned round so as to suit any portion of the driving belt. A regulating nut is provided for allowing the tension of the spring, so as to increase or decrease the speed of the engine, when not in motion. For separate adjustment, while the engine is running, a speeder can be provided.

Electric Railways.—VIII.

In continuing to-day our series of articles on electric railways, we take up a system which, if priority of working were taken into account, ought to have been mentioned first. We have, however, sought to lay before our readers the results of some of our own workers in this field first, but in giving a description of the Siemens system now we in no way detract from the credit which is due to Siemens & Halske for having first demonstrated the practical success of electric railways. Although their early attempts, such as those in 1867, failed of practical utility, their later efforts, seconded by the firm establishment of the reversibility of dynamo-electric machines, have placed them in the front rank in electric railroading. The various ways in which the Siemens system has been carried out under different conditions of working makes a *resumé* of them of interest, and in doing so we add another proposed system for the city of Vienna, which deals with some obstacles encountered there in a way that may well be applied to other cities.

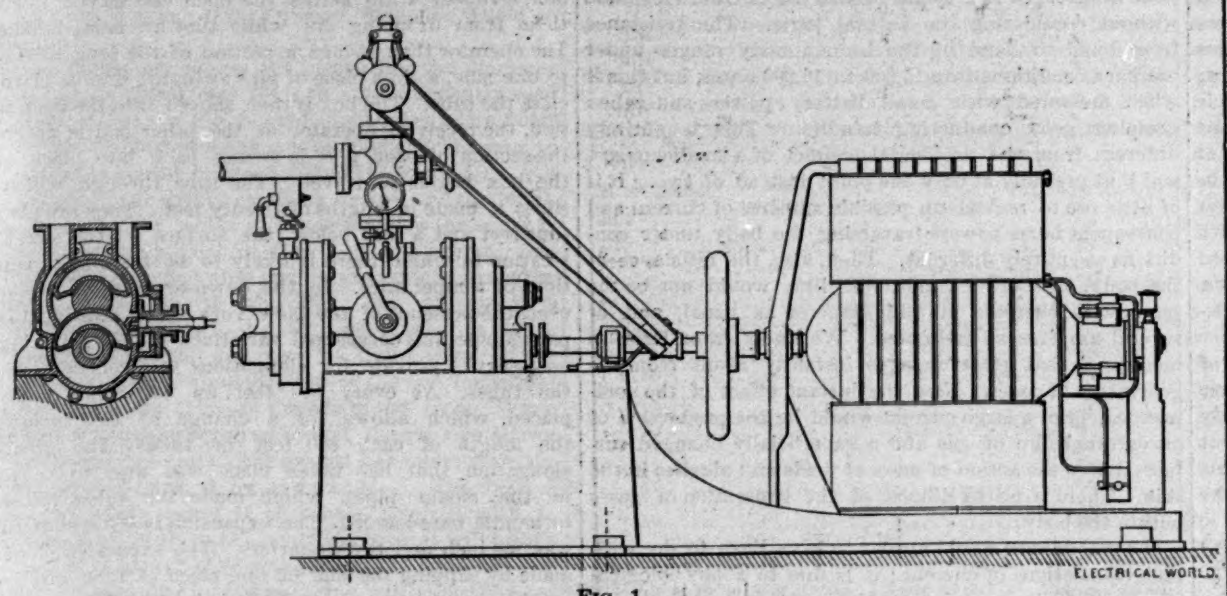


FIG. 1.

The first step which Messrs. Siemens took towards a practical demonstration consisted in the building of a short line of about 500 metres length at the Berlin Exhibition of 1879. In this they employed their well-known type of machines as generators and motors, of which our illustration shows one connected to a Dolgorouki rotary engine (Fig. 1), and a central rail led the current to the machine, the outer rails acting as a return circuit. Prompted by their success with this venture, which was the first of its kind in the employment of electricity generated by a dynamo-electric machine, similar attempts were made in Brussels, Dusseldorf and Frankfort, for exhibition purposes, with a like result. The first permanent undertaking executed on the Siemens system, however, did not take place until two years later, when, on the 12th of May, 1881, the line between Lichterfelde and the Central Cadetten Anstalt, near Berlin, was opened to the public. This installation differed somewhat in detail from the first attempts in the manner in which the current was led; for whereas in the latter a third central rail was used, the former employed only the two existing rails, one as a lead and the other as a return circuit.

Since this road has been in operation Messrs. Siemens & Halske have built numerous others, and we need only to mention those of the Paris Exhibition, at Vienna, at the Zaukeroda mines in Saxony, at Offenbach, near Frankfort-on-the-Main (and the use of the system on the Portrush Railway in Ireland), in order to show the push and enterprise of the firm, which our own electricians might take as an example.

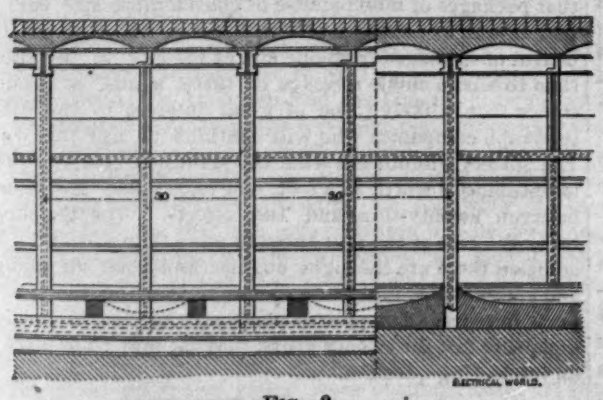


FIG. 3.

The various methods which the Siemens have employed for conducting the current to and from the motor deserve some attention, as they have by no means restricted themselves to the rails as conductors, but have devised various methods for the purpose. As stated above, their first road employed a central rail, while the second used the main rails only. In order, however, to avoid the danger of giving electric shocks to persons and animals coming in contact with these unprotected rails, and also to avoid the loss due to leakage between the rails in wet weather, recourse has been taken to overhead conductors which lead the current without the objections just named. The first and most natural way out of this difficulty was to string two wires overhead upon which small trolleys traveled. These latter were connected to the locomotive by wires which pulled them along, and thus a constant circuit between motor and generator was maintained. This method, though simple, is found not to work well in practice on account of the vibration and the varying sag in the wire, and another was consequently devised which was first tried at the Paris Exhibition of 1881 and gave satisfactory results. On this occasion the overhead conductors consisted of brass tubes, slit longitudinally and laid along small stringers of wood, so that the slit was turned downward. Within the tube there was placed a short metal cylinder, at the ends of which there projected two lugs, which passed through the slit in the tube and were connected to a small framework carrying a wheel. The latter was pressed against the lower side of the tube by springs, and thus a good contact was obtained when the wire from the locomotive was attached to the device.

At the Zaukeroda mines we find still another method employed, which is well suited to the locality. This consists in suspending two ⊥ beams with their flanges facing downwards. The lower flanges thus present a good means for the conveyance of a trolley, and the latter being provided with a brush permits of the taking-off of the current with very little loss of power. It will be seen that for mines this disposition of the conductors is a very happy one. The rough usage to which the rails are subjected, together with the frequent presence of water, makes the employment of the former as conductors impracticable; but the ⊥ rails suspended close to the roof, and attached to hard rubber insulators, leave little to be desired in the matter of efficiency. The motor at these mines weighs about 1½ tons and is capable of hauling a load of 8 tons at the rate of 7 or 8 miles an hour.

In the Portrush Railway a method is employed which differs from all the preceding ones and presents certain advantages due to the nature of the line. Here the current is led to the motor by an insulated iron T rail laid *alongside* the main rails, and from it the current is taken off by steel springs; the main rails, which are uninsulated, constitute the return circuit. Where the rails are crossed by roads, an insulated cable is laid under ground and connects the two ends of the severed rails, so that the latter, though elevated along the line, does not prevent the crossing of vehicles. As there are two sets of brushes attached to the motor, one in front and the other in the rear, it follows that at short crossings the front brush makes contact before the rear one has left the rail, and thus an uninterrupted current is maintained. Where the crossing is greater than the length of the car, the momentum of the latter carries it over to the opposite end and in this manner makes connection again.

We have entered into this detailed description of the methods employed in the Siemens system, because the difficulties involved are of great importance, and may often determine the practical success of similar undertakings. As regards a choice of conductors for electric railways, it is obvious that no definite rule can be laid down, as the method employed must be governed entirely by the exigencies of the case. We thus see that at Lichterfelde, which is but sparsely populated and has but little traffic, the rails alone were used as conductors. At Paris the case was entirely changed, for there the rails lay flush with the street, the city authorities not permitting a raised rail to interfere with the continuity of the pavement. This prevented good insulation, and, in addition, the sunken rail permitted the accumulation of dirt and other matter which would have prevented the wheels from making good contact. All this being foreseen, it became necessary to provide overhead conductors, which took the form described above. At the Zaukeroda mines the form adopted seems eminently practical, and will no doubt be copied in future installations. We might continue the illustrations farther, but those enumerated will suffice to show what has been done in that direction, and to point the way to a selection of the best method to be applied to a given case.

We now come to the consideration of the proposed Vienna system of electric railways which has been elaborated by Siemens & Halske, and which, if carried out, will undoubtedly place that city in the front rank as regards transportation facilities within city limits. The projectors start out with the correct proposition that no such railway can be run on the surface of the street, for the reason that contact with the rails would be unavoidable, especially at car crossings, and principally on account of the limited speed which surface railways are obliged to run at. Where quick transit is, therefore, desirable the solution must be sought either in an underground or an elevated system, or in a combination of both, depending upon the nature of the surface. The last named plan is the one proposed for Vienna, where the rise and fall of the ground would present too heavy grades for either one of the first two systems mentioned. It is therefore proposed to build a road in which tunnels shall alternate with elevated structures, and the manner of building both of these is given, as they give a good idea of the requirements of the case (Figs. 2 and 3).

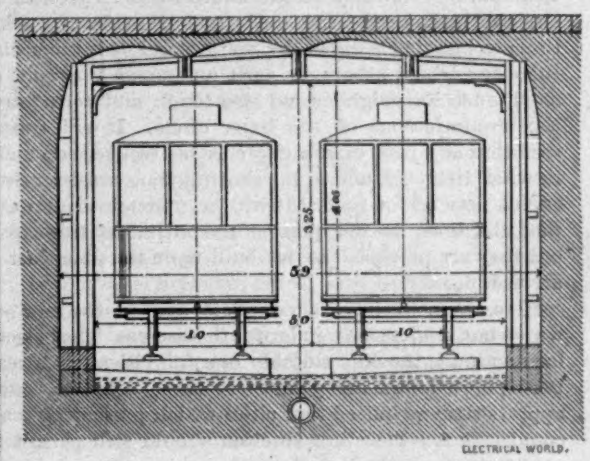


FIG. 2.

As regards the construction of the tunnel, of which we give two views, it will be seen to have a flat roof instead of an arched one. This is necessary, because the latter construction would require a greater height of tunnel, and in addition an increased width. One object in making the tunnel as low as possible is to minimize the grades in passing from tunnel to viaduct, and by making the tunnel as narrow as possible plenty of room, even in the narrowest streets, remains on both sides, for the placing of sewer and other pipes, without interfering with the foundations of houses. Ventilation of the tunnel will be effected by means of perforated plates inserted in the roof and arranged so as to catch any matter that might fall through the holes. They would so act that when a train approached one of them it would force out the foul air through the openings, and as it receded it would draw in a supply of fresh air; plates thus placed at proper intervals would maintain good ventilation. It goes without saying that the cars are to be lighted by electricity.

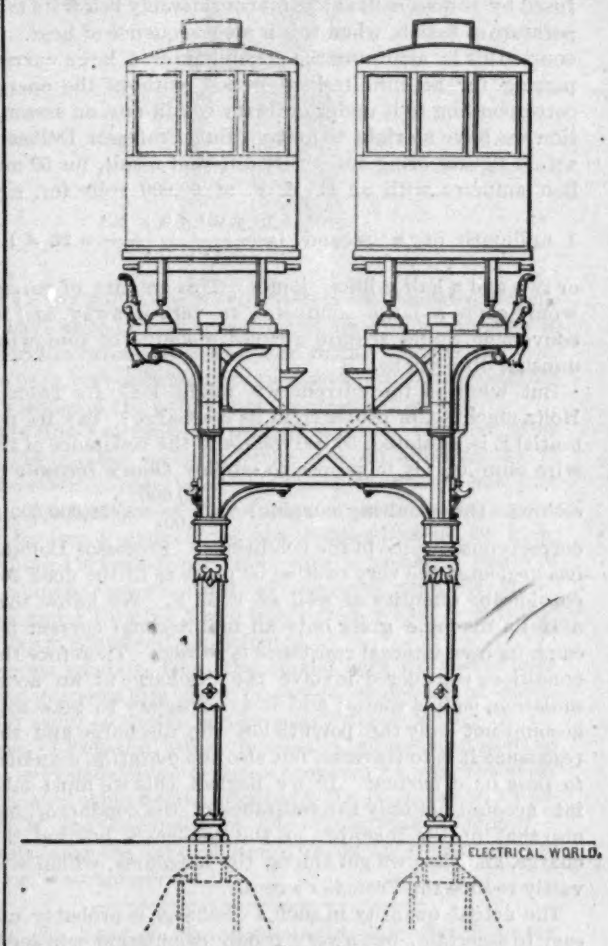


FIG. 4.

Respecting the viaduct or elevated portion of the road, an essential condition requires it to be as simple as pos-

sible. It must be open so as not to obstruct the light, and this requires the parts to be small and simple. Thus our illustration shows both rails supported by only one main girder between the rails. Besides the above named advantage, it is claimed that this construction will diminish the noise of passing trains. There are also shown two depressed platforms running along between the tracks, from which repairs can be made conveniently (Fig. 4).

The course which the lines will take in Vienna also demands attention. Although it is not proposed to build the entire road at once, it has been so planned that when complete it shall present a network which will give access to all parts of the city in the shortest time. We can best explain the course of the roads to our readers by asking them to imagine a circle drawn; around this inner circle there are drawn others in such a manner that each one shall touch its neighbor and also touch and form part of the circumference of the inner circle. It will thus be seen that any part of the city can be reached, no matter in what direction, and in the shortest time consistent with such a network of road. It will be understood, however, that the lines do not present the outline of true circles, but they are proposed to be built upon the plan just described.

Here, then, we have a complete system, the merits of which our readers may judge for themselves. That electric locomotion is the only suitable one for cities has already been pointed out many times in these columns, and it appears strange indeed that cities which present favorable conditions for their introduction should still permit the use of steam, with all its accompanying evils.

The Resistance of the Human Body.

We published recently a very interesting paper, by Prof. A. E. Dolbear, on personal safety and electric currents. The paper was reproduced by some of our English contemporaries, and in one of them Mr. J. T. Sprague makes the subjoined comments:

The remarks of Professor Dolbear are no doubt an interesting attempt to elucidate a very important matter, but some portion of them really appears to be very wide of the mark. I refer to the effects attributed to the discharge from a Holtz machine, which is estimated to produce through a wire a current of 50 million ampères, which is supposed to produce no apparent effect, because its duration is probably less than one-millionth of a second. I think both the estimate and the explanation are erroneous. The power of a current to destroy a wire is not limited to the calculated energy carried by the current. We cannot say that the wire could not be vaporized or melted unless that energy represented the heat needed for those results. The molecular motions involved in the passage of the current may disintegrate the metal and reduce it to its ultimate molecules, even though the heat equivalent were far below that required to fuse the metal; in fact, a metal carrying a current and fused by it does melt at a point considerably below its temperature of fusion, when this is a consequence of heat. Of course this is assuming the possibility of a large current passing for an infinitesimal period without the energy corresponding to it under ordinary conditions, an assumption we have no right to make. But Professor Dolbear's actual figures bring out a very different result, for 50 million ampères with an E. M. F. of 50,000 volts for, say,

1 millionth of a second is $\frac{5^{7} \times 10^{7} \times 5 \times 10^{4}}{1^{7} \times 10^{8}} = 25 \times 10^{5}$,

or two and a half million joules. This amount of energy would cause a large conductor to vanish away, and its conversion would require a Holtz machine of somewhat unusual dimensions.

But what is the current we might look for from a Holtz machine, or rather from its discharge? Say its potential E is, as stated, 50,000 volts, and the resistance of the wire ohm .001; is it proper to employ Ohm's formula to estimate the resulting current? Is $\frac{50.000}{.001} = 50{,}000{,}000$ a correct consequence of the conditions? Professor Dolbear has neglected the very caution he gives as to the need for considering quantity as well as E. M. F. We know that a Holtz machine gives only an infinitesimal current because its own internal resistance is so vast. Therefore the conditions considered involve the discharge of an accumulation, as in a spark; and it is necessary to take into account not only the potential of the discharge and the resistance it is to traverse, but also the *quantity available to pass as a current*. If we neglect this we must take into account not only the resistance of the conductor, but also that of the machine, or the condenser holding the charge, and then we get among the megohms, which will vastly reduce the Professor's result.

The actual quantity in such a discharge is probably not easy to ascertain, but a very rough calculation will serve the purpose. Taking the electrostatic system, we may consider that the balls of the conductor have unit capacity, that of a sphere of one centimetre radius, and then if we take 60,000 volts (to save fractions and 3×10^{10}) as the ratio of v, we find that the quantity is about two-millionths of a coulomb. Now, if we take the period of discharge at the highest estimated, viz., one-millionth of a second, and suppose the current uniform, we have a current of 2 ampères instead of 50 millions. Or if we consider that the capacity of the whole system of balls and jars is one microfarad, then with an E. M. F. of 50,000 volts we get only one-thousandth of the current stated. The Holtz machines have generally but a very small fraction of a microfarad capacity, so that we come to something like the first result, viz., that the ampères of current so produced must be reckoned by units, and probably far below one ampère instead of by millions.

The calculations as to the current and energy which may traverse the human body are subject to similar corrections of errors caused by the slavish use of Ohm's formulæ without considering the natural parts. The resistance from hand to hand of the human body ranges under ordinary conditions from 5,000 to 10,000 ohms, but this is when measured with small battery power and when grasping good conducting handles. This is entirely different from the accidental contact of a small surface, and that probably at only one point instead of two. It is of little use to reckon up possible ampères of current and consequent horse-powers traversing the body under conditions so entirely different. Then, also, the resistance of the body, with other conditions alike, would not be the same with currents of milli-ampères as usual, and of several ampères as estimated. We know from Edison's motograph that great changes instantly result from the generation of gases. Now the instant effect of the commencement of a large current would be the production of an external film of gas and a superficially changed surface, due to the action of nascent acids and alkalies in the skin. There is no likelihood of the generation of gases within the body.

The real danger would appear to have little to do with such calculations of current; it is due to a physiological effect of the static actions which accompany the setting up of the difference of electrical potential; it is the sudden and violent contraction which occurs in all the muscles traversed, and the nervous derangement due either directly to the molecular motion set up in the matter of the nerves in the setting up of electrical stress, or else indirectly to the effect of pain and fear, or, in the usual phrase, nervous shock. This is why our electromotive force, which is absolutely harmless when sustained and producing current, may be dangerous and even fatal in the alternating form which repeats shock after shock, and, by setting up rapid molecular motions in the organism, destroys its proper vital action. This indicates the importance of perfect insulation, and such separation of conductors as to avoid risk of getting the body into the circuit.

The Western Union Pneumatic Tube System.

A little more than two years ago, Mr. A. Brotherhood, who has charge of all the mechanical engineering of the Western Union Company, began making the drawings for the new pneumatic system. The plans included the new building belonging to the company, which has since been erected on the old Peckham homestead, at the corner of Twenty-third street and Fifth avenue, and which was designed as a distributing office for a very large territory. From the basement of this new building to the operating room in the top of 195 Broadway, four lines of brass tubes, each of an interior diameter of three inches, have been laid under Broadway. Two of these tubes are for through business, and two are intended for both through and intermediate business. The following is a general description of the system by Mr. Brotherhood:

To transmit a message the operator places it in a cylindrical leather box a trifle smaller in diameter than the tube, but having flanges at each end, which make an air-tight joint when placed in the tube. The box is large enough to hold 100 messages, if necessary. When filled it is popped into the tube, the air is exhausted before it and pumped in behind it by engines at each end, and away it goes at a trifle over a mile a minute for ordinary working speed. If in the direct tube, the box of messages can land only at Twenty-third street. If intended for an intermediate station, the operator there is notified, and by the time he can say "Jack Robinson" the box is before him. When the system is complete the box will travel with equal ease and speed from any station in any part of the city to any other station.

While the general plan of sending a box through a tube by means of air pressure is old, the details of the system are both new and interesting, from the engines that furnish the power to the reversible stop-cover that snatches the flying box of messages from the tube at just the right station. There are four engines in the basement of each building, the cylinders of each being 18×36 inches, each developing about 240 horse-power, with a steam pressure of fifty pounds to the square inch and eighteen revolutions of the fly wheel per minute. The engines act directly on the air pumps, prolongations of the piston rods working the plungers. Under ordinary circumstances two of the engines in each building will create a vacuum in one big tank and two will compress the air in another. But, when desired, the whole gang, or any number of them, can be used either to compress the air in one tank or to exhaust it in the other. Ordinarily the pressure of air in the compressed tank will be 30 pounds to the square inch. Actual experiment has shown that the exhaust has produced a vacuum of 28½ inches in the other tank, or almost a perfect vacuum. The air cylinders are jacketed with spiral water-tubes, the cold water entering at the point where the heat generated by compression is greatest. By means of simple throttle-valves worked in the operating-room, either tube can be connected through heavy cast-iron pipes with either the vacuum tank or the compressed air tank. Of course, when one end of the tube connects with the vacuum tank, the opposite end will ordinarily be connected with the compressed air tank; but this is not necessary, for the boxes can be forced through the tube by either pressure or vacuum.

The messages are simply rolled up and placed in the box, a rubber strap across the open end serving to keep them from dropping out while they are being handled. The operator then swings a section of the long tube out to one side, a close piece of pipe swinging into its place to close the tube. The box is then shoved into the open section, the receiving operator at the other end is notified, the section of open pipe is swung back into place, and the box begins to travel. The tube through which it slides is made in lengths of twenty feet. They are placed four feet and a half below the surface of the street, a location in which there is likely to be but slight variations of temperature. In the down-town portions, however, the presence of the New York Steam Heating Company's pipes has occasioned variations of 100°, making it necessary to provide for elongations and contractions of the tubes. At every 800 feet an expansion joint is placed, which allows for a change of two inches in the length of each 800 feet of tube. The greatest elongation that has taken place was due to a leak in the steam pipes, which made the tubes too hot to handle bare-handed. The expansion in 800 feet of tube was one inch and three-quarters. The expansion joint is made by slipping the end of one piece of tube inside of another one that is enlarged to receive it. The inside of the end of the inner tube is ground out to form a sharp edge, which is then tempered so that nothing running through the tube is likely to get caught. Between this sharpened end and the place where the outer tube is contracted to its normal diameter there is necessarily a short space, not to exceed two inches in length, where the diameter is so great that the air can shoot past the flange of the passing box; but as the box is as long as a common message blank, there is always one flange in the tube where the diameter is normal. The whole joint is inclosed in and held in place by air-tight collars, the details of which could not be explained without drawings. Where the common joints are made, the ends of the pipe are enlarged, so that a lengthwise section of the two ends, when placed together, would make a very flat V. The ends are surrounded by iron collars, a flange on the face of one projecting into a groove in the face of the other, where it presses against air-tight packing. They are held in place by two rings connected by longitudinal bolts.

To reach the way stations along the line, the way tubes curve out of the street and up into the operating room of the station. When a box is to be sent to a way station, the operator is notified by an electric alarm. He at once swings a section of the tube before him on one side, and swings another section, having a glass face on one side and a wire screen at one end, into its place. The screen stops the box, and the operator can see it before him. He swings it out, and the other part of the tube is thereby swung into place, so that other boxes intended for other stations pass on.

Every 400 feet along the line of tubes is a man-hole in the street, by which workmen can get down to examine the tubes. Leaks or cracks in the tubes are located by sending a box through at the end of a strong line.

When the system is complete, the present offices of the city will constitute way or central stations on the pneumatic railway. The capacity of a tube is about 1,000 messages, or ten boxes a minute. The size of a box is such that packages of merchandise of considerable size can be sent as well as messages. It will cost no more to send a boxful of messages from one end of the city to the other than to send a single message of three words, a circumstance that is likely to be of great interest to the other telegraph companies who will continue to use the wire. The officers will not tell what the plant has cost, but the bare tubing is worth $1 a foot, and 70,000 feet are in use between Twenty-third and Dey streets. The couplings bring the cost of the four tubes to more than $100,000. In addition there are the eight engines and their air pumps and compressors, and the expense of putting the whole plant in place. The present plans are expected to furnish a plant to last for twenty years. What may come after is an interesting question.

Cable Competition.—A dispatch from London of Jan. 10 says: The evident indisposition of the Commercial Cable Company to at present further reduce rates has developed a rather strong market in Anglo-American shares. It is stated that the new company's lines are overstocked with matter, but that the bulk of their work consists in the transmission of news dispatches. The pooled companies hope that this condition of affairs will continue, and state that if the Mackay-Bennett people load up their lines with press messages, private business, which is by far the most profitable, must inevitably suffer. These reports are undoubtedly circulated with a view to enticing customers away from the concern, and probably have no foundation in fact, as the Commercial Company break the messages of firms and individuals in the usual manner, giving them precedence over news, for the simple reason that they pay better and cost no more to transmit.

Overhead Telegraph Wire.—Part V.

BY WM. MAVER, JR.

During the process of drawing iron and copper wire, it is essential that the wire be frequently gauged. Especially is this true of copper wire, and in well-regulated establishments a man is generally deputed to make measurements of the diameter of the wire as it comes through the die. This is essential, because, from some of the causes already alluded to, the die may become choked up or cut out, and thus a wire of very uneven diameter would be the result.

Various forms of gauges for measuring the diameter of wire are employed, but the one most frequently used now is that shown in Fig. 10, called a pocket micrometer gauge. The method of using it is as follows: The wire to be measured is placed between *B* and the screw *C*; *C* is a continuation of the socket *D*. This socket, or cylinder *D*, slides over another socket *a*, through which the screw *C* runs; *a* is securely fixed to the U-shaped holder; *D* is beveled at one end, and this end is graduated into parts, calibrated 0, 5, 10, 15 and 20. The socket *a* is also graded, as shown by the perpendicular lines. The distance between any two of those lines is the 25 one-thousandths of an inch—that is, the one fortieth of an inch. The screw *C* has 40 threads to the inch. When the socket *D* has been revolved so that the gap now shown between *B* and *C* is closed, the graded line under *O* on the socket *a* is just covered by the socket *D*. The screw *C* being a part of the socket *D*, of course revolves with it. When the screw is given one complete turn, it will open a space between *B* and *C* of one-fortieth of an inch, and the first perpendicular line from *O* on *a* will be just covered by 0 on the beveled edge of *D*. The fractional part of a revolution of the screw to the one-thousandth of an inch is indicated by the horizontal lines on the edge of *D*.

Thus, when the screw *C* is brought out until it stands in the position shown in the figure, a wire fitting between *B* and *C* would have a diameter of 80 thousandths of an inch.

The result is reckoned in the following manner: We can see that there are, counting from *O* on *a*, four perpendicular lines uncovered; this indicates three revolutions of the screw *C*, and as each revolution equals 25 one-thousandths of an inch, we thus get 75 one-thousandths of an inch; but the screw has moved more than three revolutions, as shown by the fact that the 5 one-thousandths line on the beveled edge is opposite the horizontal line *O*. This is added to the 75 one-thousandths, making the diameter of the wire inserted as above.

The dies are measured by using a piece of wire of the desired diameter, which is inserted in the die. Should the die be too large, it is battened with a hammer; if too small, it is reamed out.

When the process of drawing wire was first adopted, the number of the gauge of a wire was indicated by the number of times the wire had been drawn through the dies. For instance, if it required ten drawings to bring a wire to a certain diameter, the gauge of wire of that size would be No. 10. It thus came about that the thicker the wire, the lower the number, and *vice versa*, and as wire of even a greater diameter than No. 1, became, for certain purposes, a necessity, the sizes were designated by ciphers until there is now a gauge of five noughts.

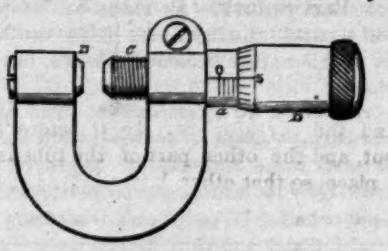


FIG. 10.

There are various wire-gauges in vogue; for instance, the Birmingham, the American and the London. Some of these gauges are arranged on a regular plan, for example, a geometrical progression in which each size is 20 per cent. more or less in weight and electrical conductivity than the size immediately preceding or following it. Others are arbitrary; that is, a manufacturer has decreed that No. 12 gauge will be 109 thousandths of an inch in diameter; that No. 14 will be 83 thousandths of an inch, etc.

A specimen of the latter is the Birmingham wire gauge, which is somewhat widely used in this country, and if it or some other particular gauge were entirely used, it would be very advantageous to all concerned; but such is anything but the case. In fact, every manufacturer has his own gauge, and thus by one standard No. 12 represents a wire 109 thousandths of an inch in diameter, while by another the same number of gauge will signify a wire 104 thousandths.

It is thus rendered necessary to add in almost every case the name of the gauge when ordering wire, or to designate the wire by its diameter regardless of gauge. Many attempts have been made at different times and by different persons to secure uniformity in wire gauges, but without success.

At the last meeting of the Telephone Exchange Association, a committee of three was appointed to endeavor to bring about such a result, and it is to be hoped they will succeed.

In this relation it has been suggested that inasmuch as, from one cause or another, previous attempts to secure an uniform gauge have failed, a plan might meet with approval in which some sweeping change should be proposed, such, for instance, as to completely turn around the present systems in which the larger wires have the lowest numbers, and to begin at No. 1, giving it the diameter of the finest wire possible to make, and then number each succeeding diameter by a regular increase of one or more thousandths of an inch, or still less if required, up to a certain point, when the increase could be made greater, and so on. For example, assuming that a wire having a diameter of 25 mils (a mil being the one-thousandth of an inch), is the smallest wire drawn, it would be called No. 1 of the new gauge, which would give us a table somewhat as follows:

No. of gauge.	Diameter in mils.
1	25
2	26
3	27
4	28
5	29
6	35
7	38
8	41
9	43
10	48
11	53
12	58
13	63
14	68
15	78
16	88
17	98
18	108

Of course, the above ratio of increase is given merely for the sake of illustration. In the event of the adoption of an arrangement in any way similar to the foregoing, the needs of the trade would be taken into consideration by the formulators of it.

FIG. 11.

A proposition was recently made to adopt a gauge for telegraph wire having for its basis the weight of the wire per mile. This suggestion would be a good one but for the fact that all metals do not weigh alike, and consequently the diameter of an iron wire of a certain gauge number would not correspond with that of a copper wire of the same number, which would entail confusion.

After all the foregoing tests of the wire have been made, each coil is again inspected, previous to weighing off, to detect, in the case of iron wire, any imperfect galvanizing that may have escaped notice on the first inspection.

The wire is then considered ready for final inspection by the purchaser, who, as a rule, sends his own examiner to inspect the wire thoroughly before accepting it, after which, if the results are satisfactory, the wire is then shipped to its destination, where the test of its qualities begins in earnest.

Every bundle or coil of copper wire intended for overhead purposes is, or should be, covered with paper or matting before shipping, as the handling and jolting received in transportation, and the consequent wrinkles and kinks, would otherwise lay the foundation for numerous future breaks.

As previously intimated, I shall now give some of the actual results obtained with hard-drawn copper wire as an overhead telegraph wire.

In the spring of 1884 the Baltimore & Ohio Telegraph Company began the erection of two lines of No. 14 B.W.G. hard-drawn copper wire between New York and Chicago. This wire weighs 110 pounds per mile, has a breaking strain of 350 pounds, and an electrical resistance of 8.50 ohms, about equal to a No. 6 iron wire weighing 572 pounds per mile.

At the commencement of the erection of these wires, one very fertile source of trouble was a lack of acquaintance on the part of the linemen with the characteristics of hard-drawn copper wire. The men having been accustomed to handling the much heavier and more tenacious iron wire, would thoughtlessly kink the copper wire, and in tying it around the insulators would give it a bend that, by almost cutting it, made bad and discouraging work with the first 40 or 50 miles erected, and breaks, seemingly without cause, were of frequent occurrence.

A prompt and searching investigation, however, speedily showed that, in almost every case, the breaks were due to ignorance on the part of the linemen and also to a weakening of the wire by heating at the joints.

These faults were at once rectified, and the remainder of the wire, owing to its lightness, was erected with less trouble than the adjacent iron wires, and with no apparent liability to breaks from above-named causes.

A top view of the old method of tying the wire to the insulators is shown in Fig. 11. The tendency, as I have said, in tying the wire in this way, is to chafe and cut the line wire at the point nearest the insulator. With care, however, this fault has been almost entirely overcome.

Other methods of tying and protecting the wire have been tried with varying degrees of success, one of which was to insert over the wire, at the insulator, a copper sleeve, about 6 inches long, around which the tie wire is wound. This has the disadvantage of being an expensive plan.

Another plan, and the one which is now recommended by the different superintendents of construction, and which will very likely be generally adopted hereafter by all companies using hard-drawn copper wire, is shown in Fig. 12. It will be noticed that by this arrangement of the tie wire there is no undue strain on the line wire, and that, while it is quite sufficient to hold up the wire, it still permits it to slip through the tie; which is an undoubted advantage; inasmuch as this allows safe play, as it were, in case of contraction by cold, and spreads the strain along a considerable length of wire, and thus advantage is allowed to be taken of any slack that may exist between some of the poles.

After many experiments with different form of joints this company has adopted a joint devised by Mr. John A. Helvin, superintendent of construction, which has been found to meet nearly all the requirements. It consists of a cylindrical brass sleeve, about one inch long, through which two parallel holes are bored, into which the ends of the wires to be joined are placed. The wires are then lapped around each other four or five times and soldered lightly at the ends of the sleeve. This form of joint has been found to possess a higher tensile strength than any other form of joint tested, breaking at almost the same strain as the wire. Having a round surface, it offers less opportunity for retaining the wires when they may happen to swing together—a good feature.

These wires have now been on the poles and in constant operation for over eight months, giving continual and exceptionally good service, and owing to their small surface area it has been found quite possible to work duplex systems on them from New York to Buffalo, and Buffalo to Chicago, without any electro-static compensation whatever. It has also been found that these wires are not so subject to breaks from sleet and soft snow as the larger iron wire, which is probably due not alone to their smaller surface, but also to their much smoother surface, which prevents the rain from lodging thereon.

In addition to the above-mentioned wires, the same company has just completed a No. 14 hard-drawn copper wire from St. Louis to Texarkana, Ark.—570 miles—for Texas business.

During the late severe cold snap, when the thermometer fell from 30° above to 20° below zero in the Mohawk Valley, in one night, much anxiety was felt as to the effect on the copper wires, but investigation showed that the percentage of breaks on these wires was slightly less than that of the No. 6 and 8 iron wires strung on the same poles.

Altogether, the results of the use of hard-drawn copper wire by the Baltimore & Ohio Telegraph Company, which, as I have already said, was the first telegraph company to go into the extensive use of this metal for this purpose, have been very satisfactory and have fully demonstrated the wisdom of the policy that inaugurated its use.

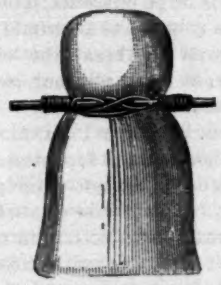


FIG. 12.

That this is so must be evident from the fact that after an eight months' successful trial of 4,500 miles of No. 14 hard-drawn copper wire, this same company has just begun the erection of 3,000 miles of hard-drawn copper wire having a diameter of 104 thousandths of an inch, weighing 170 pounds per mile, with a breaking strain of 550 pounds, and an electrical resistance per mile of 5.3 ohms, equal to a No. 3 iron wire; from which even better results are confidently anticipated.

Reports received from the copper wire in use for telephonic purposes also show favorable results, all of which would seem to verify the prophecy made by Mr. W. H Preece, of England, before the recent Conference of Electricians in Philadelphia—in which prophecy he was, however, anticipated some twelve months by Mr. D. H. Bates, President of the Baltimore & Ohio Telegraph Company—namely, that the days of iron wire, as an over-head conductor, were numbered.

All the Modern Improvements.—The San Francisco *Call* says: The Japanese are very precise and correct, as a rule, in their pronunciation of English, as they learn more or less like parrots. One day a man went into the Hiogo telegraph office with a message to be sent to Osaka. The polite Jap took it from him, looked blandly over it and then said: "You—cannot—send—this—message—to-day." "Why?" "The—gentleman—who—takes—charge—of—the—telegraph—office—is—drunk." "Indeed! is he often taken like that?" "He—is—very—frequently—drunk." "Well, what am I to do?" "If—you—will—leave—your—address—I—will—send—and—tell—you—when—he—is—sober."

An Analytical and Systematic Method of Inventing.

BY EDWARD P. THOMPSON, M. E.

(*Continued from page 255, Vol. IV.*)

The present article is a continuation of subjects for invention, and will be followed by principles to be applied to inventions.

SUBJECTS FOR INVENTION.

In order to work out a mathematical problem it is necessary to have given the complete data or else it is absolutely impossible to obtain the correct result. In the same manner, in the consideration of one or more of the following or preceding subjects, this suggestion, as well as others already offered, should be borne in mind.

63. REFINING OF METALS BY ELECTRICITY.—Just as soon as the current begins to deposit the pure metal from the anode of impure or mixed metals, a thin layer of oxides, poor conducting metals and earthy substance forms upon the surface, and although comparatively thin, increases the resistance and thus causes a loss of energy. To remove this scum requires an especial gang of men who do nothing else all day long except lift out the anodes, clean them and replace them. An effectual and automatic device or process probably would save the current otherwise lost and certainly the wages of so many men.

64. TELEPHONE RELAYS.—At the weekly meeting of the branch association of the American Institute, held at Cooper Union, on the 8th inst., some of the data given by those who took part were of the following nature: the vibrations at the receiver are so weak as to be heard with difficulty if the line wire is about a hundred miles long. However, the current producing these vibrations has some strength at least, or else the diaphragm would not vibrate at all. As force cannot be made out of nothing, it follows that the vibrations of the current cannot add power to themselves from themselves, and therefore the relay must be an instrument which will employ this weak current to set into action a stronger current according to the principle illustrated by a child which is able to project a bullet through a fence by simply exerting enough force to pull the trigger of a gun. It does not follow, however, that a telephone relay must be similar in construction to a telegraph relay.

65. BINDING POSTS.—They have, heretofore, generally consisted of a fixed tubular socket for the conductor, provided with a binding screw arranged to turn in a screw-threaded aperture formed at right angles in the socket, the extremity of the screw being adapted to impinge directly upon the conductor and bind the same in the socket. In this construction, owing to the direct lateral pressure of the point of the binding screw against the conductor while being turned, much damage has been done to the latter, its surface being bent and mutilated, and the conductor has been frequently cut and completely severed within its socket. This form is the simplest of construction of those in the market. For large currents, a binding post of comparatively simple construction would be useful, which could serve to complete or break the circuit without producing a spark, or, at least, without too much danger of giving the manipulator a shock.

66. VARYING THE LIGHT OF INCANDESCENT LAMPS.—Provision has so far been made for attaining this result by means of various devices; but principally by arranging outside the lamp, coils of wire or sticks of carbon. The praiseworthy inventors aim to obtain means for introducing into the circuit all or part of a carbon filament located either inside the lamp or in a separate bulb exhausted by gas, the object of the invention being that of economizing space.

67. ELECTRIC GAUGE FOR STEAM BOILERS.—This should consist of practical means whereby signals are given when the water has fallen to a certain level; or of automatic means whereby water is pumped in and kept automatically, by C., an electrical regulator, at about a constant level. The data given are the rise and fall of the water completing or breaking directly or indirectly the C. which may serve to give the alarm or intermittently set the pump working. Devices for doing this constitute inventions.

68. PROPULSION OF VESSELS.—To drive an electric motor by a steam engine and the paddle-wheels or screw by the motor, with an efficiency of less than 100 per cent. in each case, would be simply extravagant, but the generation of C. directly from heat and applied to the motor would contribute an invaluable invention, provided the thermopile be constructed upon more novel principles and of considerably more economical efficiency than the present thermopile. The development of C. directly from heat is a work for the investigator rather than for the inventor.

69. ELECTRIC BAROMETER.—It has been stated that the height of an ordinary table has been measured by means of the ordinary barometer. To measure the difference of height of the mercury column, for such slight difference of vertical distances above the level of the ocean, requires a standard of very accurate workmanship and therefore very expensive, and a telescope, even more expensive than the barometer itself. The electrical principles which would most probably be applied in a practical electric barometer would be those pertaining to the relations of the pressure of a gas to the electric current; or to the effects of the C. upon the vibrations of the pendulum; or to the effect of the pendulum upon the C.; or to the relations of the C. to gravitation; or to the resultant effect of the moisture and temperature upon the C.; or to the effect of the C. upon the combined effects of moisture and temperature; or to the combination of two or more of the above-named effects or relations. An electric barometer consists also of an electrical device whereby the height of the column may be read at any distance from the barometer, or whereby the different heights are automatically registered at the same or at different localities.

70. ELECTRIC PEN.—Different forms of electric pen are generally those in which a sharp point is made to vibrate by means of the current, and thus cause the writing, which may subsequently be used as a stencil, to consist of numerous and minute holes. A means of writing by an electric pen suggests extreme rapidity, whereas the present electric pen writes more slowly than the ordinary pen, although copies can be made from the original. It may appear an impossibility to imagine the least approach of an instrument which would write simply by talking to it, and yet be so cheap and simple as to be employed by those who need it most, and which would produce characters capable of being made intelligible to the human mind and of such a nature as to be classified and remembered. Words generally can be uttered faster than they can be put on paper, as all of us cannot be stenographers; nor can every one afford to employ a stenographer, nor do those who employ them make as large a profit as if they had an instrument to take the stenographer's place. The invention need not consist of an instrument which will register intelligible characters by merely talking to it; but of means which are equivalent to such an instrument.

71. BLEACHING BY ELECTRICITY.—The efficiency of this process has not yet been sufficiently compared with the ordinary processes; but its efficiency as regards the elements of time and convenience has been established. There is room for invention, not so much in the direction of a novel process, but in that of novel devices to be employed in the process. To liberate bleaching elements or compounds by the C. to bring the bleaching substance instantaneously and uniformly into contact with the material to be bleached; to operate the machinery by the C.: to recover the bleaching elements by the C.; to make the process possess automatic devices, and to prevent the elements from poisoning the workmen are directions in which inventions may be made.

72. ELECTRO-DEPOSITION OF CARBON.—To make carbon filaments for incandescent lamps; to make artificial diamonds; to make battery and arc lamp carbons; to make electrodes for telephones; to make rheostats; to make joints for fastening carbon filaments to their terminals, are some of the uses of electro-plated carbons, provided any improved process will give a superior reguline deposit.

The data are soluble or fusible compounds of carbon and C.

73. ELECTRIC GUNS.—Electric guns proper are those in which the projecting force is that of electrical energy. Such a gun could never amount to any further practical use than that of a mere toy or curiosity. The term "electric guns" generally refers to guns containing a device whereby the explosive is ignited by the electric spark, and whereby several guns may be fired at the same instant, and whereby the guns may be manipulated, if desired, at a considerable distance.

74. ELECTRIC FURNACE.—Heat produced by electrical energy is more expensive than when obtained by other means; but as the heat produced by an electric arc is the most intense of any at present attainable, and as the expense is of little importance in some instances, and as there may be new uses to which electric furnaces may be applied, and as electric furnaces are at present very few and of rude constructions, it appears that this subject deserves a place in the list of inventible articles. Some of the advantages connected with it are as follows: it can be put into readiness simply by turning on the C.; the heat may be generated in the midst of the mass and not necessarily on the outside of the vessel containing the mass; and the fusion may be effected by constructing the electrodes of the metal which is to be melted, provided suitable devices and means be invented for maintaining an arc while the electrodes are melting, and for preventing the combustion of the metal.

75. DENTAL MALLET.—Late improvements indicate a preference for such construction as allows the weight and clumsiness to be diminished by the location of parts of apparatus, not in the handle, but at a distant place, even as far as the adjacent room.

76. DETECTING BULLETS IN THE HUMAN BODY.—Metals occurring in the body sometimes produce pain at any distance from its true source, so that other means than pain are necessary for detecting the metal. It has already been proved that there is no general invention which is of such a scientific nature as to be depended upon under all circumstances. In this department, as well as in electrical communication between vessels at sea and in many other departments, it is apparent how useful would be an instrument for—

77. DETECTING NEARLY INFINITESIMAL CURRENTS.—Let a thermopile of one couple be connected with a circuit of wire of a small diameter and thousands of miles long, and it becomes apparent that there is no means of detecting the minute C. which doubtlessly occurs. The nearest approach is Highton's galvanoscope. Such an instrument would not be expected to measure the C. nor even to indicate its direction; but simply to inform one whether or not a C. were passing. The problem consists in producing an effect upon some of the five senses directly or indirectly by converting a very small quantity of electrical energy into heat, light, magnetism, chemical affinity, adhesion, cohesion, gravitation or any of the other forms of energy known or to be known. It is quite surprising how really large is the smallest C. which may at present be detected even by the most sensitive means.

78. ELECTRIC GAS METER.—Supposing that gas will still be used by skeptics in electric lighting, and that the gas meter will continue to exhibit one's latent faculty for lying, it would not be a useless task to get up a genuine electric gas meter, and then it might be discovered that it could also be employed by electric companies as a gas electric meter. Water gas meters are objectionable, and mechanical gas meters are more so, while an electrical gas meter might be most so; however, its efficiency can not be predetermined.

79. ELECTRIC PYROMETER.—To determine high temperature of a furnace, or of any source of intense heat, seems a process which should certainly be accomplished directly by the C., as the readings may then be taken instantaneously at a distance. There is room not only for improvement, but for original invention, and there is a chance, therefore, of applying some of the principles of science to new ends.

80. DETECTING HEAT BY ELECTRICITY.—It is often necessary, in scientific investigations and in meteorological observation, as well as in other practical departments, to be able to detect very minute traces or small variations of heat. The thermopile is, as far as I know, the most valuable and practicable method, and will detect the heat of a star; but it would not be able to detect the heat developed in a telephone receiving diaphram, the heat being produced by the mechanical vibrations of the said diaphragm against the opposing electrode; nor would it detect the heat produced in a large wire by the passage of a current from one pair of a thermopile; nor would it detect the heat produced by compression of a piece of metal by another piece of the same weight; nor would it detect the heat or cold of an approaching object with any degree of sensitiveness, the said object being, for instance, a vessel at sea or an iceberg.

81. DETECTING CHEMICAL CHANGE.—To know whether there is any change in the nature of the compound of animal and vegetable matter and something as to the quality and extent of this change, requires at present long chemical analysis. Chemical change is indicated as taking place by its effects; but if these effects are not very large, an instrument is needed to detect them.

82. REMOVING INK AND STAINS BY ELECTRICITY.—The principles concerning the relations between C. and chemicals are to be studied if it is desired to devise an apparatus suitable to be used by people void of skill.

83. DETECTING OR MEASURING LIGHT AT A DISTANCE BY MEANS OF ELECTRICITY.—As there are some substances which will separate the light rays from the heat rays an invention of this nature becomes possible, but perhaps not very probable.

84. TESTING OILS BY ELECTRICITY.—The quality of an oil for lubricating cannot be determined by a simple inspection; but needs some instrument, improved as much as possible, whereby its lubricating properties may be quickly and cheaply tested. To put it on a temporary and rotating bearing and journal and thus determine its qualities is a fair process, but no process or device is so perfect but that there is reason to hope for better. The problem to be solved is the coefficient or relative coefficient of friction between the oil and some standard material such as iron.

85. RESTORING GOOD QUALITY OF EATABLES BY ELECTRICITY.—To manufacture all kinds of eatables or even to preserve them may be impossible; but to restore them to their natural and healthful condition may yet become an industry, although perhaps not in the present generation, so that it will not be necessary to do more than simply hint at the idea.

86. EXTINGUISHING FIRE BY ELECTRICITY.—Houses have been set on fire by the C. and therefore it might be thought foolish to suggest the idea of extinguishing or preventing fire by the same agent; but upon second thought and by a careful consideration of electrical and other principles, possible direct or indirect, although, at present, not clearly practical, ways will gradually offer themselves.

(TO BE CONTINUED.)

Street Lighting in Philadelphia.—Contracts for furnishing the City Electrical Department of Philadelphia with supplies for the ensuing year were awarded by Chief Walker, on Jan. 10. The United States Electric Lighting Company was awarded the contract for furnishing twenty-six lights on Delaware avenue at 59½ cents per night, and the Brush Electric Light Company was given the contract for seventeen lights on Poplar street, between the Delaware River and Sixth street, at 58½ cents per night.

They Can Lay Wires.—In Chicago on Wednesday, Dec. 24th, the State court of Illinois dissolved the injunction against the Baltimore & Ohio Telegraph Company, which was obtained several months ago on the application of the Chicago Sectional Underground Cable Company, restraining the Baltimore & Ohio Company from laying underground wires in Chicago in consequence of an alleged exclusive grant for such work from the Chicago Council to the Sectional Company. The Baltimore & Ohio Company at once completed its arrangements, already begun, for laying underground wires from its main offices to the new Board of Trade Building.

The Bankers & Merchants' Prospects.

As referee in the suit of Alexander H. De Haven, a stockholder, against the Bankers & Merchants' Telegraph Company and its receivers, who were appointed in the sequestration suit brought by Austin G. Day, a judgment creditor of the company, Thomas S. Moore has reported that the receivers should be allowed to issue $1,500,000 of certificates, which should be a first lien on the company's property, and the proceeds of which should be used in settling all claims against the company excepting those of the holders of its mortgage bonds. In his report Referee Moore stated that the Bankers & Merchants' Company had in its treasury $99,000 of the bonds under the mortgage of $10,000,000 given by it to the Farmers' Loan and Trust Company; $5,115,000 of them were in the hands of purchasers, and $4,786,000 of them were pledged as security for its notes representing $784,874.18. Besides the notes last mentioned the company owed $372,209.37 to unsecured creditors for work and material, $145,000 on coupons of bonds of the Southern, Trade, and American Rapid telegraph companies, which corporations it controls; $290,000 on bonds issued under a mortgage of the New York & Washington Line, $8,700 as interest on those bonds, $4,800 for taxes, $130,000 on receivers' certificates, issued to enable the receivers to get possession of certain Western branch lines, and $97,000 borrowed money, for which the receivers are yet to issue certificates. The $130,000 of certificates were made special liens on the property they were issued for.

Referee Moore also reported that if the gap between Hammondsport, Ill., and Chicago, and that between Meridian, Miss., and New Orleans were closed, as they could be readily and cheaply as the material for the connecting lines was on the ground, the business of the company would be greatly benefited. In Referee Moore's opinion, receivers' certificates, if made a first lien on the property of the company, could be sold for par, or not less than 90, and that the proceeds of the sale of $1,500,000 could be made to redeem every liability of the company, excepting the bonds issued under the ten-million-dollar mortgage. Judge Donohue has made an interlocutory decree reappointing Messrs. Newcomb and Smith as receivers of the company, and authorizing them to issue the certificates representing $1,500,000.

The Cincinnati Electrical Society.

The Cincinnati Electrical Society has ended the first year of its existence with good results, and there seems to be a future of prosperity opening before it. The annual report has been presented by Mr. J. O. Shiras, recording and corresponding secretary, as follows:

"Our twenty-ninth meeting on Dec. 20, 1884, closed the first year of our existence. It is gratifying to know that we have survived this length of time, for the life of electrical societies in Cincinnati heretofore has been short, and we know of none that lived long enough to make an annual report. The Electrical Society of the Ohio Valley started with fair prospects and a large membership, but died young, not having survived one year. It accomplished some good, however, inasmuch as the few remaining members voted its library to our care and merged their society into ours. Our society had a very modest beginning. A few persons desiring to study the subject of electricity met every Saturday night. After these meetings had been continued for some time the Ohio Mechanics' Institute, about the oldest institution in the city, proposed to these members that they join the Institute and form an electrical section of the same. The advantages offered by the Institute were: A meeting-room, with light and heat, a good library, and some electrical apparatus and all the privileges possessed by members of the Institute, such as free admission to all their public lectures, use of the library and periodical literature on science, art and technical subjects, which is the best and most extensive collection of periodicals in the city—and without an increase in expense—the annual dues being about what it cost in the original society, namely, $3 per member. The proposition was accepted, and the society met at the Institute for the first time on Saturday evening, Feb. 23, 1884, and has met there ever since at the regular time with but one exception. We have held twenty-nine meetings at the Institute and about five previous to joining the Institute. The present number of members is eighteen. The number of new members added during the year is seven. The average attendance at each meeting was about twelve. The total number of visitors during the year was forty-four. The discussions were voluntary, none being by appointment. Members feeling so disposed prepared themselves and made their own apparatus and experiments. The subjects for discussion were generally taken out of standard electrical books and treated in the order and manner found therein.

"A good deal of attention has been given to the study of electrical units with good results. The following apparatus and experiments have been made by different members of the society:

"A set of instruments illustrating the subject of electrodynamics, being a multiplier and movable wires for angular, parallel and sinuous currents; apparatus to show the rotation of vertical by horizontal currents; rotation of currents by magnets, rotation by liquids; solenoids; a Camacho electro-magnet, made in sections; an electro-motor, without core to armature; an astatic galvanometer; a thermo and secondary battery; the Wheatstone sliding-bridge apparatus; a reflecting mirror galvanometer. With these instruments the principles and experiments for which they were designed were successfully shown, besides quite a number of other original experiments. From this it will be seen that our society has not given itself up to mere study of books and writing of essays alone, but by actual work and demonstration with the apparatus has acquired much useful knowledge.

"As a society we have apparatus of our own, but the Institute possesses the following, which are at our disposal: A large Holtz frictional machine, a set of very fine Geisler tubes and Crooks' apparatus for radiant matter, a good-sized induction coil, a six-cell bichromate battery. The apparatus constructed by the members from time to time have always been at the disposal of the society. We have not as yet received any donations of books or apparatus, although we have some promises."

The report closes with a list of 37 books owned by the Electrical Society of the Ohio Valley, and presented to the Cincinnati Society for safe keeping.

Luminous Phenomena of Electrolysis.

If acidulated water be electrolyzed by an intense current —1 to 5 amp.—with the aid of two platinum wire electrodes, and the circuit be closed by slightly immersing the cathode, a greenish light will appear at the cathode, an energetic disengagement of gas ensue, the platinum and the liquid become heated, and the force of the current diminish considerably. If the current be rendered sufficiently intense, the noise will suddenly cease, the light become stronger, and the liquid assumes a spheroidal state, leaving the cathode, and forming round it a kind of funnel.

During the continuance of this phenomenon gas will be disengaged normally at the anode; but, if the immersed surface be diminished, the action will be reversed, provided the current be sufficiently intense. The Russian savant Slouginoff has inquired into the conditions which determine the production of this kind of abnormal electrolysis, its causes and effects, and arrives at the following conclusion: When the platinum of the cathode has closed the circuit by its contact with the liquid, the elevation of temperature at the point of contact may become sufficiently great to evaporate the nearest particles of the liquid in such a manner as to again interrupt the circuit. The extra current increases the effect which is reproduced the following second, when the liquid, thrown off by the vapor generated, again comes in contact with the cathode, in such a way that the intermittences of the current are repeated indefinitely. A greater intensity of current produces a truly stable spheroidal condition. This explanation is borne out by a series of facts, ascertained by experiments, of which the following are the principal. A telephone placed in one branch of the principal circuit, or in the secondary circuit of a Ruhmkorff coil introduced into the principal circuit, causes a more or less loud sound during the abnormal, energetic electrolysis; but this sound becomes scarcely perceptible while the spheroidal state continues. The introduction of a coil into the main circuit, and also that of an iron core into this coil, increases the intensity of the sound, while at the same time lowering the note; and the extra currents, intensified by the coil, permit of the phenomena taking place with a less number of elements. Kœnig's revolving mirror decomposes the light of the electrode into a series of sparks, the configuration of the image showing that the sparks succeed one another round the electrode along a trajectory in the form of a spiral. The luminous electrode is quickly disaggregated, the liquid after the experiment containing a black powder, which is found to be platinum black. The spectrum of the light from the cathode is continuous; and in the case of very intense extra currents a few platinum lines and traces of the hydrogen spectrum may be seen.

If a solution of chloride of platinum, gold, or silver (in the hydrochloric acid) be adopted for the electrolyte, a very vivid light is obtained, produced by the incandescence of the powder from the reduced metal, which, after the experiment, is found suspended in the liquid.—*London Electrician.*

Train Lighting by Electricity.

Although this country may well claim to be ahead of England in the number of arc and incandescent lights now in use, as was attested by Mr. Preece in his recent article, which we published, we must nevertheless concede that, as regards train lighting by electricity, the English people are ahead of us. It would appear, therefore, that in this respect our railroad managers exhibit considerable conservatism in the adoption of new appliances, and that for the nonce we are distanced by the alleged slow-moving Briton. It must be admitted that the problem is by no means easy of solution; the two systems, that by storage and that by direct lighting from a dynamo on the engine, each present advantages and disadvantages which make the adoption of either a matter of mature deliberation on the part of those concerned. We understand that the Pennsylvania Railroad, with its usual enterprise, has for some time been experimenting on the subject; but as yet nothing definite in the way of a general adoption has been settled upon. They are evidently watching the outcome of the experience which our English cousins are undergoing, and which, so far as we are able to learn, has proved quite satisfactory.

The sentimental objection that has been raised, that, by the method of direct lighting, the lights are extinguished whenever it may be necessary to uncouple the locomotive carrying the dynamo, has been taken up and answered by the correspondent of an English contemporary, as follows:

"Whether this objection is a sentimental one or not I cannot say; such a point would have to be settled by the traveling public at large. But permit me to say that (even excluding the use of accumulators) there is no reason whatever why the lights should be extinguished for a single instant, although the train might be left standing without its locomotive for any length of time. All that would be required is a dynamo fixed in the station where the trains are made up, and the provision at suitable places along the platforms of flexible twin cables in connection with the main leads from the dynamo. Some of the coaches in each train, or preferably all the coaches, should be provided with terminals connected to the main leads throughout the train, which would fit a clip attached to the end of each pair of flexibles. To prevent reversal of polarity the clip should be so arranged that it will only go on one way, and the flexibles might be stowed away under the edge of the platform in the same way as are the india-rubber gas pipes.

"Immediately a train comes in, the nearest flexible cable would be clipped on to any of the terminals within reach, and for the time being the train would be lighted jointly from the dynamo on the locomotive and from that fixed in the station. After detaching the locomotive the station dynamo will continue to light the train until a new locomotive is coupled on. I need hardly point out that the dynamo in the station, with its engine, leads, flexibles, and clips, would be far cheaper than a set of accumulators for every train, and would also have the additional advantage of serving at the same time for the permanent lighting of the station."

From the above extract it is apparent that the writer is in favor of the direct system, and it cannot be denied that, looked at from a certain standpoint, it presents advantages over the storage system. We are inclined to believe that, with the advent of some good motor and dynamo which will occupy a minimum of space, the problem will be nearer a solution than at present. The field for improvement in this direction is quite large, and the demands which the electric light has made upon engine-builders are still unsatisfied in this particular direction.

Electric Lighting in Canada.

From a published interview with Mr. Munro Lee Ross, Manager of the Royal Electric Company, of Montreal, we extract the following items:

All the electric lighting in the city of Montreal is done by the Royal Electric Company. It owns three buildings in that city, in which all its plant is located. The lighting station in the rear of the city is running 310 Thomson-Houston lights. Its full capacity is 500. The Royal Company has obtained the contract for lighting the entire city of Ottawa. In addition to 175 city lights, many contracts have been made for private lights. The Edison Company furnished the plant for the Parliament buildings.

The Royal Company has also built a station at Quebec for the Quebec & Levis Electric Company, which has a large number of private contracts to fill, and also those of lighting the Provincial Parliament buildings and the government drill sheds. There will be something over 100 lights.

At Peterboro a local company has been formed, which has secured the contract for lighting the city, and many private lights as well. The number of lights now running there is over 100.

At St. Catharines a local company is operating 50 lights by means of water-power supplied from the Welland Canal.

At Hamilton a company is now in process of organization. Contracts for 50 lights have been secured, and a 100-light station is to be erected.

At Halifax an electric light company has been organized with a capital of $80,000. The plant is to be furnished by the Royal Company and will provide for 140 lights of 2,000 candle power each. The prospects of the company are very bright.

At St. John the new station on Paradise Row is completed, and power for 100 lights is supplied by two 50 horse-power engines and two 75 horse-power boilers. About 50 lights are now running, which number will be extended to 100 in a short time. The Royal Company has supplied a large number of small plants for isolated companies and private parties in Canada. This has all been accomplished since the 18th of last March, when the Royal Electric Company started its factory in Montreal. The system used is the Thomson-Houston.

About 200 lights are running in Toronto, and the number is increasing daily.

The city of Portland was the second city in Canada to adopt electric street lights. Those used are of 1,200 candle power.

It will be seen from the above that the use of the arc light is rapidly extending through the Dominion.

Darkness at Hell Gate.

The electric light at Hell Gate went out on Saturday morning, Jan. 3, at 4 o'clock, and the brilliant illumination was withheld until Tuesday evening. The stoppage of the electric light was caused by the fact that a part of the screws attaching the armature to the shaft gave signs of being loose. The attendant engineer, noting this, decided that it would be advisable to cut off the light. Owing to the circumstance that there was a lack of proper tools, such as those which are in use at the Cleveland factory, the repairs occupied the time from Saturday until Tuesday.

"Since the light was first placed at Hell Gate last November," said Mr. C. P. Whitney, secretary of the Brush-Swan Electric Light Company, to a reporter, "there have been no mishaps worth calling by the name. Once a couple of globes were broken by a bird and the lights went out. Of course the weather has once or twice occasioned annoyance. One night the lights went out owing to the presence of sleet on the elevator, which kept the attendant from going up. The government is perfectly satisfied with the apparatus and its workings, and the plant has been fully settled for."

Mr. Whitney stated that a duplicate apparatus had already been ordered, so that such a delay in electric lighting of Hell Gate could never occur again. "The original objection of the pilots," he said, "which was not very general, is, we are assured by the government officers, entirely removed. During the nights in which the lights were out there were many complaints from parties using the water about Hell Gate. Great regrets were expressed at the absence of the lights. Some of the captains of the Sound boats, I have been told, have concluded that it was a very great advantage to have the Hell Gate electric illumination, and that it was materially useful in navigation. It certainly is," concluded Mr. Whitney, "a permanent institution, and is now generally understood to be such."

The American Electrical Exhibition.

The Boston *Herald* of Jan. 11 says: Quite a number of schools from neighboring towns and cities have applied for reduced admission rates to the Electrical Exhibition and been granted such by the management. Excursions are being arranged everywhere, and the closing weeks of the Exhibition will doubtless prove very successful. Arrangements have been made with a well-known lecturer to deliver lectures on electricity to the visiting schools in the upper hall. These lectures will be delivered before the children are admitted to the Exhibition Hall, so they may enter the same more understandingly; and, under guidance of teachers, such visits must prove naturally beneficial to the scholars. Several new exhibits are being arranged now. One of them is an illustration of the application of the electric light at sea. A handsomely rigged bark will carry the starboard and port light (red and green), as well as the bow and masthead lamps, all lights, of course, being electric and more intense than those now commonly in use on vessels. The attendance at the Exhibition is very large, and increases as the closing days approach, and it is quite noticeable that the visitors belong to the best class of people. The electric railway is doing quite a business, carrying passengers around the balcony; but, as the jarring affects somewhat the transmission of music from the Bijou Theatre, the management has arranged a time-table which restricts the railroads from running at all times, and dividing the time of "laying off" between the electric organ and the phonograph. The phonograph has been put into a more conspicuous place in a neat little pagoda under the music stand in front of the Edison cottage, and seats are arranged now for the listeners to this wonderful instrument. This will give more freedom to the operator, and is a great protection to the apparatus. The little chickens attract every visitor, and are alone well worth seeing.

The Treatment of Sugar by Electrolysis.

The complete extraction of juice from what is generally but erroneously called beetroot—*betterave* is really mangold wurtzel—is rendered very difficult on account of the presence of alkalis in the juice, which prevent the crystallization of the sugar. A process for neutralizing these alkalis has been patented by M. Despeissis, says the London *Electrician*, whose invention has this further advantage, that the salts contained in the saccharine solution are obtained in such a manner that they can be turned to profitable account. The process is founded on the fact that if an electric current be made to traverse a liquid containing a salt in solution, the base of this salt, which is decomposed, is transferred to the negative, and the acid to the positive pole. If there be a porous diaphragm between the two poles, so that the current may pass, but the two liquids can only mingle slowly, the acid and the base of the salt, set free, cannot immediately recombine. The current is to be produced by dynamos or batteries; and the electrodes that M. Despeissis prefers to use are those of carbon or platinum, while the porous jar may be of unglazed clay, carbon or parchment. During the electrolysis, it is especially the carbonic acid which is disengaged, and this acid, which partially remains in solution, is not injurious to the sugar, while it may also be neutralized by lime. When the liquid is raised to a suitable degree of heat, this carbonic acid is neutralized by the formation of insoluble carbonates, which, on being deposited, also take with them the coloring matters. The syrups and molasses may be treated by the action of heat; and this method has the advantages that the hot liquid offers less resistance to the electric current, and is sufficiently fluid to render the addition of water unnecessary. Moreover, the high temperature facilitates the escape of the gases which are not deposited on the electrodes. The elimination of the alkalis is effected by means of a filled vessel placed in the juice, and in which the negative electrode is immersed; it is also advantageous to immerse the positive electrode in a porous jar filled with water, and placed in the body of the juice. In this manner the acids and the iron contained in the saccharine matter go to the positive electrode, and the alkaline bases to the negative electrode. The porous jars facilitate the separation of these substances, which are injurious to the saccharine juices, thus permitting a higher proportion of crystallizable sugar to be obtained.

Revenue from Poles and Wires, Philadelphia.

Chief Walker, of the Electrical Department, has prepared a summary of the returns made to him by the different telegraph, telephone and electric light companies and others controlling poles or wires, in compliance with the ordinances of December 21st, 1880, and January 6th, 1881, requiring returns to be made in duplicate, under oath, on or before the first Monday of January.

On January 3d, Chief Walker sent duplicate copies of the returns for attachment of wires to city poles to the City Treasurer, together with the returns for the maintenance of wires overhead, and for underground wires and cables. The returns of poles belonging to parties other than the city were not sent because of the proposed reduction in the license.

The summary referred to shows the rental of city poles for 1885 to amount to $7,643.50 for attachments, and $1,375 for wires. For poles other than those of the city the returns amount to $4,528; for wire on such poles, $6,320, and for wire on buildings, $4,145, making a grand total of $24,011.50.

The returns for conduits, as required by the ordinance of March 30th, 1883, were as follows: National Underground Electric Company, $80; Henry C. Gibson and others, $100; Philadelphia Sectional Underground Company, $120. For wire underground the returns were: Henry C. Gibson et al., $338; Philadelphia Sectional Underground Company, $10, making a grand total for underground wires and conduits of $648.

The Tropical Telephone Company.

The treasurer's statement Jan. 7 showed the following, no account being taken in the assets of subsidiary stocks and contracts, patent or other rights, of the Trinidad, W. I., exchange of 140 subscribers, and various other items:

ASSETS.

Cash on hand in bank	$24,011.93
Due in cash from sub-companies	17,109.37
Notes receivable March 15	4,229.55
Total	$45,350.85

DEBTS.

Due for instruments and supplies	$10,879.98
Due to sub-companies	657.40
Notes payable, $4,028.62 Feb. 15.	
" 5,000.00 March 21	9,028.62
	$20,566.00
Assets in excess of debts	24,784.85
Total	$45,350.85

The company announces a dividend of 10 cents per share in their first, and said to be the first of any American telephone company operating in foreign territory. The issued share capital is $361,180 (36,118 shares, par $10), 3,882 shares remaining in the treasury. As the stock has never, it is believed, sold above $2.50 per share, and most of it cost the holders less than $2, this dividend is at the rate of 8@10 per cent. on the investment.

The sub companies are the Inter-Continental, the West India, the Columbia & Panama, the Companhia Nacional de Electricidade of Rio de Janeiro, the Companhia Telephonica do Brazil, the West Coast, the United Telephone Company of the River Plate, the Compania Electrica de Cuba, and the Guatemala. The Barbados Telephone Co. (Limited) has bought the exchange established in the island of Barbados.

The Tropical Company has a stock interest in all these different companies operating under exclusive license and contract, and supplies them with instruments and apparatus at a fixed price and fair profit.

The present earnings and surplus are derived entirely from these contracts, which run for a term of years; and when the sub-companies begin to yield dividends the income of the Tropical Company will be materially increased.

A Big Cable.—One of the largest cables, if not the largest, in use in telegraph service underground, has just been laid in Boston, along Friend street, from the Old State House to the Western Union Office. It is a kerite telegraph cable, 60 conductors, and contains over eight miles of wire, the distance between the two points being only 644 feet. The cable is run through a 3-in. wrought-iron pipe. The work was performed most expeditiously and satisfactorily under the superintendence of Mr. E. McClees.

Carbon Products from Natural Gas.

An open letter in the January number of the *Century* says: "The products of natural gas are numerous. The most important thus far are lamp or carbon black and carbon points for the electric light. There are ten carbon black works in operation, making 3,000 pounds of black per day. At a remote point in Armstrong County, Pa., a Boston firm has large works locally known as 'the mystery,' on account of the secrecy with which it is conducted. Here they make the black and, it is supposed, coloring matter also from the gas. At Stuartson furnace, in the same county, is another 'works' where the carbon points are made. Both these works are guarded and a stranger is not permitted to be about them. A number of persons are experimenting with the gas, with as many different objects in view. It is impossible to learn what has been accomplished, as they are quick to see the advantage of keeping secret any discovery they may have made. What the future of this wonderful fuel is it would be difficult to foretell. Natural gas springs are known to exist in many parts of the United States. This would seem to indicate a wide distribution of it. In August last a large well was struck at Crestline, Ohio, which may open a vast territory. Where gas may or may not be found can only be determined by the drill. How far it may influence the manufacturing interests of the years to come depends upon its supply."

What Was It?

To the Editor of The Electrical World:

SIR: Noticing the clipping from the Manchester *Enterprise* of Dec. 25 in THE ELECTRICAL WORLD, referring to an electrical disturbance in the Ann Arbor Exchange, I would say that this company has had a somewhat similar experience. About October 1, 1884, on a clear evening, the Williamsport Edison Electric Illuminating Co. started up for the first time their plant in this city. Shortly after starting, probably about 6 P. M., in our Williamsport Exchange we got a flash that threw down at least 100 annunciator drops, and at intervals of perhaps three to five minutes the flash would recur, throwing from 50 to 150 drops at every flash. It was plainly caused by the electric light current, from the peculiar buzz noticed in the telephones. The Light Co. finding trouble on their circuits, discovered some of their wires afoul of a gas pipe inside of a store building, on clearing which the trouble ceased. It should be noticed that the main ground on the Telephone Exchange has a gas pipe, together with water pipe and ground plate connections. We are confident that all the aerial wires were free of anything like a cross with electric light wires. Can it be that the enormous charge of current from the electric light wires to the gas pipe was seeking an additional escape to the earth at distant ends of additional telephone lines, or that anything like a discharge from the earth to the air was taking place, as in the case of lightning it is claimed sometimes to do, and in this case through our Exchange grounds and switch-board drops? I would be glad to have some one explain the matter. Is Ann Arbor blessed with an electric light plant?

R. M. BAILEY.

WILLIAMSPORT, Pa.

[Ann Arbor has electric lights.—ED. E. W.]

"One Between the Eyes."

To the Editor of The Electrical World:

SIR: I regret to perceive that on two or three occasions you have extracted from a paper called the *Mechanical World* some strange and peculiar remarks about units of measurement. Until you mentioned that this paper was a London paper, I was laboring under the delusion that it was American, for I have never seen it nor heard of it except through your pages and those of the London *Electrical Review*.

I find on inquiry that this remarkable exponent of English scientific knowledge is produced in Manchester—the home of Joule. It is difficult to conceive how any paper that pretends to circulate knowledge can allow its pages to be sullied with such wretched rubbish. The writer has run amuck on the assumption that a watt is an electrical unit. It is the unit of power, however expended, and power is the rate of doing work. Whether it be a candle burning, a man rowing, a horse plowing, a steam engine working, a wind-mill grinding, or a water-wheel sawing, the work done per second in each case can be expressed in watts. The watt is a fraction, $\frac{1}{746}$ of a horse-power, in the same way that a "foot-pound per second" is the $\frac{1}{550}$ of the same quantity. Electric currents are the result of the expenditure of power, and since a watt is expended in maintaining a current of one ampère through one ohm, we have mechanical units and electrical units directly connected. A watt is in fact .736 foot-pound per second. Hence we can say that a sperm candle expends 71.4 foot-pounds per second, and that a gas jet expends 46.37 foot-pounds per second per candle, but it is simpler to say in the one case 97 watts and in the other case 63 watts. The watt is now a regularly accepted and recognized unit.

It is remarkable how often sciolism veils itself in ridicule, but it is seldom that such crass ignorance as this *Mechanical World* exhibits has disgraced the pages of English scientific literature.

W. H. PREECE.

LONDON, Dec. 29, 1884.

THE TELEGRAPH.

The submarine telegraph cable between Senegal and France has been completed.

The "Faraday."—A dispatch dated St. Johns, N. F., Dec. 24, 1884, says: The cable ship "Faraday" is just in, having repaired the Mackay-Bennett cable. She sails to-night for London.

The Commercial Cable in the Stock Exchange.—The new Commercial Cable Company began operating an instrument in the long room of the Stock Exchange on the 13th. It was stated that messages were being sent over the new cable between the New York and London Stock Exchanges in just six minutes.

Millions of Miles of Wire.—The London *Electrician* prints the cable statistics of the Mackay-Bennett cable inauguration, bringing these to the fore, and puts the length of all submarine cables at sixty-eight odd thousand miles, or nearly three times the circumference of the globe, giving each cable an average of forty wires. The total length used amounts to 25,000,000 miles, ten times the distance between the earth and the moon.

The B. & M. Co.—Several share and bond holders of the Bankers and Merchants' Telegraph Company held a meeting on Friday, 19th ult., to suggest, discuss and, if possible, adopt self-protective measures. That something ought to be done to prevent the property from going to complete ruin was admitted by all present, and into the hands of a committee, consisting of Dwight Townsend, John A. Washburn and William G. Davis, were committed the interests of the security holders for care when some concerted action on the part of the bondholders has been taken.

The War in the West.—A dispatch of the 8th from Indianapolis says: "The telegraph war is on here between the Western Union and Baltimore & Ohio companies. At first the Western Union attempted to meet the Baltimore & Ohio cut by opening a Mutual Union office, with the rates the same as the Baltimore Company, but to-day it has entered the fight on its own account. It has reduced rates between this city and Cincinnati and Chicago to 20 cents to meet the rate of the other company, while it is giving members of the Board of Trade and the brokers a private rate of 15 cents to the above-named points."

A $200,000 Judgment.—Judgment was given by Judge Barrett, in Supreme Court, Circuit, this city, Jan. 5, for $200,000, with interest from 1870, in favor of the Republic of Mexico against the American & Mexican Railroad and Telegraph Company, a corporation of this State, and its sureties, Joseph Britton, George G. Taylor, Jeremiah Gurney and Charles W. Baker. The suit was for the forfeiture of a bond given to the Mexican Government in 1869 to insure the construction by the defendant corporation of a railroad and telegraph line from El Paso across the States of Chihuahua and Sonora to Guaymas and other ports on the Gulf of California.

On the Fastnet Rock.—A dispatch of Jan. 5 from London says: "The Kangaroo steamer, belonging to the Telegraph Construction and Maintenance Company, has just sailed with a cable to connect Lloyds' signal station on the Fastnet Rock with the postal telegraphs of the mainland at Crookhaven, Cork. The work of laying the cable will be carried out as quickly as the weather permits. The Fastnet, as perhaps some are unaware, is the first Atlantic signal on the south of Ireland and the landfall for all steamers from New York. These can be signaled from it from four to five hours before they reach Queenstown, consequently the importance of connecting this station by telegraphic cable for the purpose of giving early notice of the approach of steamers from America can scarcely be overestimated."

More about Jablochkoff's Sodium Battery.—In this new battery, which acts by the effect of atmospheric moisture upon the metal sodium, a small rod of this metal is flattened into a plate, connected at one end to a copper wire. There is another plate of carbon, not precisely the same as that used for arc lights or ordinary batteries, but somewhat lighter in texture. This plate is perforated and provided with small wooden pegs. The sodium plate is wrapped in silk paper, and pressed upon the carbon in such a manner that the wooden pegs penetrate the soft sodium. For greater security the whole is tied together with a few turns of fine iron wire; care being taken that the wire does not form an electric contact between the sodium and the carbon. The element is then complete, the carbon and the small copper wire being the electrodes. The sodium, on exposure to the air, becomes oxidized, forming caustic soda, which with the moisture of the air dissolves, and drains gradually away in the form of a concentrated solution; thus constantly exposing the fresh surface of the metal, which renders the reaction continuous. The price of the element is lower than would be expected at first sight from the employment of so expensive a metal. The present cost of sodium is 10 francs per kilogramme; but Mr. Jablochkoff thinks that on a large scale the metal might be obtained at a very low figure. The elements are grouped in sets of ten, hung upon rods in such a manner that the solution as formed may drain off. Such a battery continues in action as long as the air contains moisture; the only means of stopping it is to shut it up in an air-tight case. The electromotive force depends on the degree of humidity in the air, and also upon the temperature.

THE TELEPHONE.

A Good Rise.—It is said that the stock of the original telephone company in France has appreciated about 1,000 per cent., although there are not more than 10,000 telephones in use throughout the republic.

A Successful Experiment.—M. Van Rysselberghe's experiments in simultaneous telephony and telegraphy over the line between Lisbon and Oporto, a distance of 193 miles, are reported to have been perfectly successful, and it is proposed to apply the Van Rysselberghe system to all the Portuguese telegraph lines.

Improving on Blake.—The Montreal *Witness* has the following: A gentleman recently showed our reporter a simple device he had adopted for rendering loud talking unnecessary when using the telephone. He had put a funnel made of card board into the mouthpiece of the telephone, and this so concentrated the sound that, as he informed the reporter, he could make himself heard distinctly by speaking in a low tone of voice. If this device works so well its general adoption would do away with the shouting and repetition which is generally necessitated in carrying on a conversation over the wires.

Another Injunction.—The long pending suit of the Bell Telephone against the Overland Telephone Company, for the purpose of preventing the defendant's company from using a patent transmitter and receiver, was before the United States District Court, Philadelphia, Jan. 7, on an argument for a preliminary injunction. E. N. Dickerson, of New York, and Charles Howson, of Philadelphia, appeared for the complainant, while A. Q. Keasby, of Newark, N. J.; S. S. Hollingsworth, of Philadelphia, and Samuel A. Duncan, of New York, appeared for the defendants. The judges were Butler, of Pennsylvania, and Nixon, of New Jersey. The injunction has been granted to the Bell Company.

Long-Distance Telephony.—Application has been made for a charter for "The American Telegraph and Telephone Company of Pennsylvania," which is to be a branch of the American Bell Long-Distance Telephone Company. The immediate object is to operate a telephone line between Boston, New York and Philadelphia, and ultimately to connect with Pittsburgh and Washington. The line is already nearly completed between Boston and New York, and in about two months it is expected that the company will be ready to let out private wires between Philadelphia and New York. Copper wires are used. The incorporators are J. E. Kingsley, Thomas B. Doolittle, Samuel B. Huey, Josiah R. Adams and Francis E. Bucher.

The New England Co.—The November statement of the New England Telephone Company, says the *Traveller*, shows that the gross earnings for the month were $76,737.43; the operating expenses $55,774.69 (a decrease of about $7,000 as compared with October), and the net income $20,962.85, or about $2,000 more than for October. The construction expenditures were $22,746.85 or $1,784 more than the net receipts. The lines are now all in most excellent shape, and for for several months to come the construction expenses will be much lighter than of late. For the first time in its history, the company shows a loss in subscribers for November, the number of instruments put in being 350, and the number taken out 372, making a net loss of 72. This was due principally to the removal of telephones at various summer hotels, which had been put in for the season only. The report of instruments for December shows a gain of about 20, with one exchange yet to hear from. The aggregate number of instruments now in use is 17,331. The general financial report for December will be very much better than for either November or October.

THE ELECTRIC LIGHT.

Cheapening Gas.—It is reported from Ann Arbor that the electric light has brought down the price of gas there.

New Bedford's Rink.—A large rink for roller-skating has been opened at New Bedford, Mass. It is illuminated by five electric lights.

In Favor Among Printers.—The offices and printing rooms of the *Neues Tageblatt*, of Vienna, are lighted by 300 Edison incandescent lamps.

In London.—The Alexandra Palace management has given the contract for lighting that immense building to the Gülcher Electric Light and Power Company.

Boulton Carbons.—The Boulton Carbon Company gave an "opening reception" to its numerous employés on the 2d inst., at the works, on Wilson avenue, Cleveland, O. We have not yet heard how the affair went off.

Mobile, Ala.—At a meeting of the Electric Light Co., held on Jan. 5, it was announced that the full capital stock of $15,000 had been subscribed. The president was authorized to order a plant at once, and it will be put in operation as soon as received.

In a Confectionery Store.—The Brush Electric Co., of Cleveland, O., have just completed an installation of 50 Swan lamps, with a self-regulating Brush incandescent dynamo, in the confectionery store of M. Costello, 929 Broadway, New York City.

Nocturnal House-building.—Mrs. Mark Hopkins, widow of the late California millionnaire, is about to build a $5,000,000 house at Great Barrington, Mass., and the electric light will be used for the night operations at the blue stone quarry to furnish the stone. The whole job will occupy 1,000 men three years.

Schuyler E. L. Co.—We have to acknowledge the receipt of a very handsome and convenient combination memorandum pad and calendar from the above-named company, of 17 Nassau street, New York. Each sheet shows the works of the company at Hartford, Conn., the dynamo, and the arc and incandescent lamps.

The Excelsior in Brooklyn.—The first two floors of the new dry goods stores of Wechsler & Abraham, in Fulton street, Brooklyn, will be lighted by the Excelsior arc lamps. There will be 60 lamps on the two floors of this magnificent building, and they will add materially to its attractions. Five dynamos in the basement will furnish the current.

Brush Low Tension Dynamo.—Mr. John G. Lowe, of the Art Tile Works, Chelsea, Mass., was, it is said, the first to use this type in New England. The capacity of his machine is 75 lamps of 20 candle-power each. Mr. Lowe, who started with the tallow candle set in a lump of clay, now claims that he has the best artificial light known or produced.

Electric Light vs. Dynamite.—If the electric light had not been suppressed on London Bridge there would have been great difficulty in attaching dynamite to the pier. There is a sentiment in London in favor of placing electric lights on all bridges and public buildings. The London public take kindly to the American theory that each electric light is as good as a policeman.

"Fort Edison."—An esteemed correspondent, who has gone to see the New Orleans Exposition, writes us: "The Edison display at the Exposition is simply grand, and Messrs. Byllesby and Steiringer cannot be praised too highly for it. The dynamo battery is known as "Fort Edison." The "Fort" contains six Armington & Sims 14½ × 13 engines of 125 h. p. each, and 12 dynamos of 500 lights each. The Exposition is not yet ready to open, and Feb. 1st will hardly see it ready. Do not be misled by bad reports, although there is some foundation for them."

The Ullman Electric Gas Lighter.—Another form of portable electrical gas lighter has been introduced, in which the spark is produced not by an induction coil actuated by a battery, but by the conversion of the mechanical force exerted by the hand upon a button. For this reason the arrangement is called by its inventor an "everlasting" gas lighter. The exterior appearance of the apparatus, as published in *La Nature*, exactly resembles that of the battery lighters already introduced, the working parts being inclosed within a vulcanite handle, and the spark emanating from metallic points at the end of a suitable rod. The handle contains an inner concentric tube, which is caused, by proper gearing, to rotate rapidly when the button is firmly pressed; and by this rotation a small statical electrical machine is constituted, which in due course charges a tiny fixed induction coil, whereby the spark is caused to appear at the interrupted portion of the circuit. The apparatus, therefore, works upon the principle of Sir W. Thomson's "replenisher." The perfect operation of the arrangement is much facilitated by the fact that the electrical portion of it is hermetically inclosed in a suitable case, the inclosure being also kept dry by the insertion of a small quantity of absorbent material. The mounting of the apparatus is said to be strong, and not likely to get easily out of order.

Combined Engine, Dynamo and Search Light.—The French Minister for War, says the London *Electrician*, appears to have definitely adopted two sizes of a combined arrangement of steam engine, dynamo-electric machine, and search light for guarding against night attacks, and for searching the battle-field after an engagement. The larger size includes a Brotherhood engine, with vertical Field boiler mounted on a 4-wheeled truck and a pair of large wheels; a Gramme dynamo, the armature of which makes 1,200 revolutions a minute, giving a current of 68 to 70 ampères, and a difference of potential at the terminals of 38 to 40 volts; and a Mangin aplanetic mirror. The latter possesses the same property as the parabolic mirror—that of making parallel the rays from a source of light placed in its focus, and has the great advantage over the latter that it may be ground by mechanical means. This mirror is set in the end of a short, slightly conical sheet-iron tube, inside which is placed the arc lamp, which may be adjusted so as to occupy the exact focus. After numerous trials it has been found possible to entirely exclude automatic regulators, and only to use hand-regulated lamps. The maximum of light, which is in this case 33,000 candles, is obtained when the positive carbon, which is a little behind the negative with respect to the mirror, has a vertical face, thus sending a flood of light on the mirror. The lamp has two carbon holders, which a double-threaded screw permits of bringing together as the carbons are consumed, so that the arc always preserves the same position—that is to say, the focus of the mirror. When the apparatus is in use the lamp and mirror are dismounted from the carriage and placed on a convenient stand.

APPLICATIONS OF POWER.

To Try the Electric Motors.—At a meeting held at the house of Mr. Cyrus W. Field on Saturday night, the 10th inst., the report of the counsel of the American Electric Railway Company was presented by Mr. David Dudley Field and Edward N. Dickerson. One result of the meeting, as stated by Mr. David Dudley Field, was the assent of the Manhattan Railway Company to a trial of the electric motors of the various rival companies represented in the American Electric Railway Company upon the Second avenue line. The trial will be made within a short time. The companies that will take part in the trial are the Field, the Edison and the Van Depoele, and permission has also been given to the Daft Company to compete if it so elects. No contract has, however, been entered upon by the Manhattan Company for the use of electricity in the place of steam in the event of the practicability of the new motive power being demonstrated.

On the Bridge.—The Daft Company will begin the work of laying rails for their electric motor, which is to run on the Brooklyn Bridge, within a few days. The rails are now being delivered at the bridge, and as soon as the insulators, which are of porcelain, are ready, they will be put down. The rails are a little heavier than those now in use for the cable cars, and will be placed a foot from the cable, so as in no wise to interfere with it. Both tracks will be laid with the third rail. The dynamos are now ready. Two of them, of 50 horse-power each, will be used in the operation of the road. They will probably be stationed in Vandewater street and wires carried to the bridge. The motor which will draw a bridge car is of a 65 horse-power pattern. The experiments will be made with the motor between the hours of 1 and 5 A. M., and if it proves satisfactory the Daft people will offer to run the night cars by electricity. After complete trials have been made cars will also be run at stated times during the day, sandwiched between the regular cable runs, in order that the public may see the working of the electric railroad.

MISCELLANEOUS NOTES.

A Very Pure Bessemer Steel.—Sir Henry Bessemer has announced that, by the use of a very pure charcoal pig-iron and its treatment by a special method, a Bessemer steel is produced which on analysis is found equal in purity to the highest brand of steel made from blistered bars.

Warming Railway Carriages by Electricity.—Some experiments in this direction have recently been made at the works of M. Meritens, in the Rue Boursault, Paris. Current is generated by a Gramme machine, and produces heat in boxes externally resembling the present foot-warmers, where it is evenly distributed by a special appliance and radiated into the carriage.

Magnetized Embryos.—Professor Carlo Maggiorani read recently before the Accademia dei Lincei an account of his experiments on the action of magnetism on the development of the embryo. He submitted eggs undergoing artificial incubation to

the influence of powerful magnets. He found that the cases of arrested developments were four times more numerous with the magnetized eggs than in those beyond magnetic influence, and that the deaths of chickens were more numerous.

Magnetic Moment of Wires.—With the view of ascertaining the difference of magnetic moment in a solid cylinder and a bundle of wires, P. Bakmetieff filled a hollow cylinder, 148 mm. long and 32 mm. inside diameter, with iron wires of 1, 2 and 5 mm. diameter, and magnetized them by more or less intense currents. The magnetic moment of the finest wires, as well as their specific magnetism, considerably exceeded those of the two others, especially in the case of intense magnetizing currents. But when, instead of filling all the free space of the cylinder, he only inserted an annular layer of iron wires, the specific magnetism of the fine wires became, from the same current, many times greater than that of the thicker wires.

Electro-Magnetic Separation of Iron from Zinc Ore.—The mining engineers of Friedrichssegen, near Oberlohnstein, in Germany, have been successful in separating iron from zinc in a blende conglomerate. After a preliminary and inexpensive roasting, which renders the iron magnetic, the ore is crushed into small pieces and thrown into a hollow revolving cylinder, inside which radiating electro-magnets are arranged. The magnetic iron is attracted by the magnets and adheres to them, while the blende falls through one end into the pit. Only a quarter horse-power is required for driving the dynamos that excite the magnets, and for rotating the cylinders. Eight of these appliances treat 48 tons of ore in 12 hours, separating 7 tons of blende containing 30 per cent. of zinc, and 18 tons of iron ore containing 38 per cent. of iron and 10 per cent. of manganese.

STOCK QUOTATIONS.

Telegraph, telephone and electric light quotations on the New York Stock Exchange, Boston Exchange, and elsewhere, are as follows:

TELEGRAPH.—Am. Cable, b 52⅛ a 54; B. & M., b 3⅛ a 5; Mutual Union, b 10 a 15; Postal Stock, b 1¾; Postal sixes, b 22; Western Union, b 57¼ a 57⅝.

TELEPHONE.—Am. Bell, b 265; Erie, b 18¾ a 19; New England, b 34½ a 35; Tropical, b 1⅛ a 1¼.

A dispatch of the 13th from Boston says: The feature of the local stock market was the announcement just at the close of the morning board that the Bell Telephone Company had been granted an injunction against the Overland Company, both of New Jersey and Philadelphia, and including the parent corporation. This suit was brought to restrain an alleged infringement of the patents controlled by the Bell Telephone Company, and while the decision gives them only a temporary injunction, the opinion given by Judge Butler in the injunction practically settles the matter finally in their favor. With the disposition of this controversy the worst phase of litigation in which the company has been involved ever since it commenced business is disposed of. The Bell Company's stock, on the strength of to-day's decision, sold up after the board to 260, and later still 265 was offered for it, a gain of 15 points over the opening.

The Lowell *Courier* says: It has been observed that, within a few weeks Erie Telephone stock has been considerably firmer at quoted prices than New England. We said some time ago that the former was intrinsically more valuable, share for share, than the latter, as was acknowledged by officials in both companies. The October and November figures of the two companies more than confirm this view. Thus: The Erie earned in October net, above operating expenses and construction, $12,371.78; while New England ran $4,487.48 behindhand the same month. In November Erie earned net, above operation and construction, $14,169.07, while New England ran behind $1,784. In other words Erie is earning handsomely, while New England is losing money. It is but fair to state, however, that the New England construction account is just now considerably swollen by extensive additions, which makes the showing exceptionally bad. But when we consider that the Erie capital stands really at about $2,640,000, while New England stands at about $7,500,000, the gross earnings show which is intrinsically the stronger. In November the Erie did business which gave it a gross income of $47,177.24, while New England, with almost three times as much capital, had only $76,737.43. In other words, with 2.84 times as much capital New England did only 1.62 times as much business.

ELECTRIC-LIGHT.—Edison b 60.

BUSINESS NOTICES.

The Electrical Supply Co.'s branch store, at Chicago, is now open, and ready to fill orders for all kinds of supplies in their line.

The Brady Mfg. Co.—Mr. James Brady has disposed of his business carried on at 257 and 259 Water street, Brooklyn, N. Y., to the Brady Mfg. Co., of York and Washington streets, Brooklyn (near the Bridge). Mr. Brady is treasurer and manager of the company, and will have entire charge of the mechanical department of the business. This is in itself a guarantee of excellent work.

OUR ILLUSTRATED RECORD OF ELECTRICAL PATENTS.

PATENTS DATED DEC. 30, 1884.

Device for Applying Electricity to the Human Body; E. H. Thurston, Hagerstown, Ind..... 309,897

Consists in a combination of a suitable electric generator, main conductors, branch conductors, electrodes for applying the current, and a pole-changer, with, preferably, a switch in addition to the pole-changer.

Electric Arc Lamp; J. B. Allen, Springfield, Ill.... 309,816

The carbon electrodes are semi-circular, and feed towards each other through semi-circular tubes, each electrode consisting of two carbons meeting at an acute angle. The invention embraces means for feeding such carbons.

Electro-Magnetic Dental Plugger; J. H. Van Ness and M. A. Bland, Charlotte, N. C..... 310,099

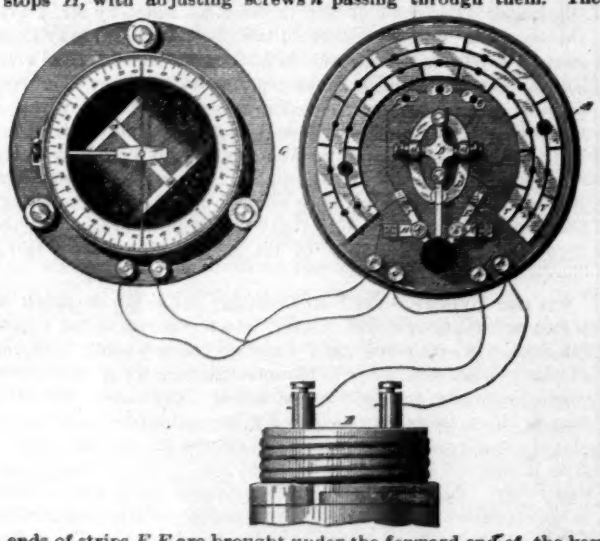
Consists in locating the circuit breaker, not in the plugger itself, but at any distance from the latter, and in suitable modifications necessary.

Electric Gas Lighter; C. W. Weiss, Brooklyn, N. Y..... 310,002

By turning a thumb-screw, which operates the spark generator, a projection strikes against the gas cock and turns it so that the gas is turned on just before any spark occurs. The electric charge is obtained when the thumb-screw rotates a piece of lead upon any resinous substance.

Electrical Measuring Apparatus; M. G. Farmer, Newport, R. I..... 309,937

In the space inclosed by the plates *T* is mounted a key *D*, pivoted at *d*, and provided with front and back stops. On each side of the key is secured a spring contact-strip *E F*, over which are stops *H*, with adjusting screws *h* passing through them. The



ends of strips *E F* are brought under the forward end of the key lever, where is a contact plate that depresses both springs simultaneously when the key is depressed. The plate *A* has four binding-posts *m n o p*. Post *m* connects with the outer row of the plates *T*; post *n* with the metal base of the key *D*. Connection is also made by a wire from the base of the key *D* to the first of the series of plates *C*. By other wires connection is established between the last of the series of plates *C* to the strip *F*, and from this to post *p*. The strip *E* is connected with the end plate of the inner row of plates *T*.

Electrical Gas Lighter; A. R. Molison, Swansea, England. (Patented also in England)..... 309,971

The construction is such that the means by which the electricity is generated are hermetically inclosed in the case or box, whereby the atmospheric moisture cannot exert any disturbing effect on the inducing mechanism in the box, so that the device is always ready for action and capable of furnishing a spark to light the gas in a house or in a gas engine.

Electric Arc Lamp; A. Davidoff, St. Petersburg, Russia. (Patented also in England, France, Belgium, Italy and Austro-Hungary)..... 310,124

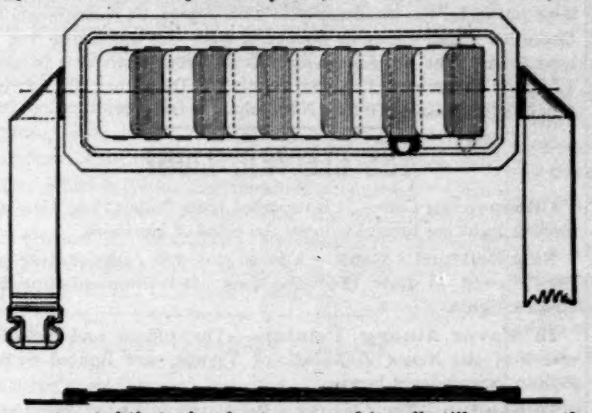
Consists of a central electro-magnet and a series of pairs of fixed and movable carbon-holders around said electro-magnet, which controls all the movable carbons, in combination with automatic switches, for bringing the pairs of carbons successively into action as the preceding pair are consumed.

Galvanic Battery; E. Weston, Newark, N. J..... 310,004

He uses with elements composed, respectively, of pure zinc and pure mercury, a neutral solution of sulphate of zinc of known strength containing a given quantity of mercurous sulphate. The cells he makes entirely of glass in such manner that they are hermetically sealed, and the conducting wires he seals in the glass. The main advantages resulting from this construction are that the action of this solution, of which a relatively large quantity is used, is more even than that of the paste. The strength of the solution is definitely known, so that the cells may be at any time duplicated, and the perfect sealing prevents leakage or evaporation.

Thermo-Electric Pad; S. C. Kram, Cincinnati, O... 310,140

The invention consists in the construction of a thermo-electrical pad adapted to be attached to some article of wearing apparel so that it may be completely insulated on its base, and



so constructed that when bent or curved it will still preserve the metallic contact between the metallic couples of all the series forming the pile, and also attach the metal plates to the pad, so that the liability of breakage of the pivoting-points is obviated, and yet connected so that each member of the series may be readily separated by a short bending of the pad and separately cleaned, and any impurities which may become lodged therein removed.

Galvanic Polarization Battery; C. A. Faure, Paris, France. (Patented also in England)..... 309,939

The invention is made up of seven sub-inventions as follows:

1. The supporting electrodes consist of thin perforated plates.
2. Leaves of parchment are placed between these plates after the active material has been applied mostly on the surface and not in the perforation.
3. A porous medium surrounds the parchment to hold it in shape.
4. The conducting support of the positive electrodes is from two to six times as massive as the negative.
5. A positive plate is placed between two negatives.
6. Conducting cross bars for holding the electrodes are provided.
7. Cells are made of cement lined with impervious material.

Insulator; H. L. James, Junction City, Kan..... 310,059

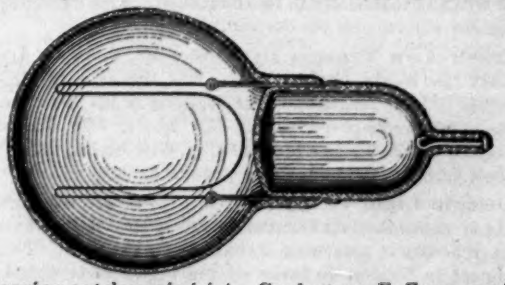
The conducting wire is inserted into a groove made to receive it, and plates are inserted into dovetail slots made to receive them, and act to hold the conducting wire in its proper position.

Method of and Means for Joining Sections of Conduits for Electric Conductors; B. Williams, Chicago, Ill..... 309,907

Consists in a method of joining the sections of asphaltum concrete conduits, consisting of first placing the sections in position and connecting their wire cells or leads, then forcing a hot-blast into the space between their ends to soften the material, then forcing into the joint, under pressure, a quantity of the same material in a plastic or liquid state.

Incandescent Electric Lamp; O A. Moses, New York, N. Y..... 310,145

The parts *A* and *B* are put together to form the vacuum chamber, inserting the tube *B* within the neck *a*, so as to form an



overlapping or telescopic joint. Conductors *F F* are made to pass through this joint at different points upon the exterior surface of the tube *B*, and the parallel outer and inner surfaces at the joint are then fused together.

Polarization Battery, or Electric Accumulator; C. A. Faure, Paris, France. (Patented also in France)..... 309,838

Consists of an electrode comprising a conducting support provided with receptacles extending through the support, active material in the form of leaf lead or metal foil corroded by acid, crumpled and packed in said receptacles, and applied also on the surface of the conducting support. The receptacles are formed by interlocking strips of lead or foil, as in the manufacture of baskets.

Regulator for Electric Lamps; C. S. Buckingham, New York, N. Y..... 310,119

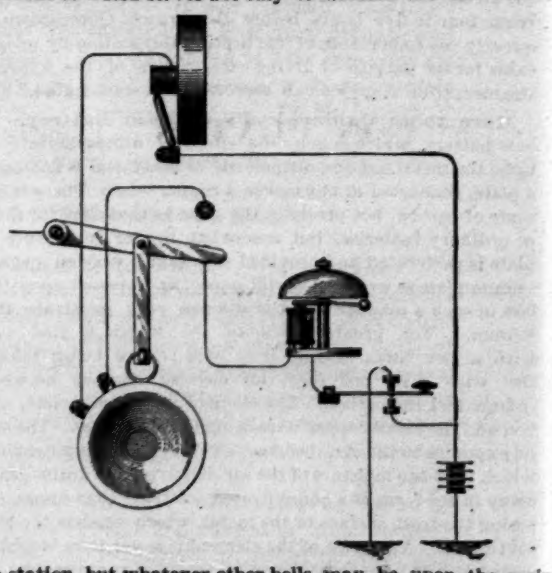
Lamps are generally provided with two coils. One of said coils, commonly known as the "coarse-wire coil," forms a part of the arc branch, and serves to separate the carbon electrodes of the lamp to establish an arc, while the other coil, commonly known as the "fine-wire coil," and being included in a shunt to the electric lamp, acts to overcome the force of the coarse-wire coil and to cause the electrodes of the lamp to be fed together under the positive action of a spring, gravity, or other agent. He employs, instead of a single coarse-wire coil, two coarse-wire coils, forming parts of two branches which begin and reunite on the same side of the arc.

Secondary Battery; W. A. Shaw, Pittsburgh, Pa., Assignor to the Electrical Accumulator Company, New York, N. Y..... 309,886

Consists of the combination of parts the principal of which are granular, active material; and a retaining-case of porous fabric stretched on a frame of wood for holding the said active material.

Telephonic Apparatus; F. F. Taylor, Brooklyn, N. Y..... 310,094

Upon a supporting case there is carried a transmitter, a signaling bell, a circuit-closing device and a switch. In the normal condition of the apparatus the main-line circuit passes through the coils of the signaling bell and to the earth. By simply operating the key, however, a battery is connected with the main line, the current of which serves not only to actuate the bell at the



home station, but whatever other bells may be upon the main line. When it is desired to place the transmitting instrument also in circuit, it is accomplished by first removing the receiver from a suitable hook upon which it hangs, and then placing the switch in contact with a point connected both through the receiver and the transmitter with the battery. When the receiver is supported upon the hook, it serves to retain the switch out of this latter position, completing the circuit connections through the signaling bell in the manner described.

Time-Indicating Apparatus for Electric Circuits; J. C. Wilson, Boston, Mass..... 310,106

The transmitting apparatus for the time-signals consists of two multiple signaling devices, one having a series of signaling surfaces corresponding to the hours of the day, and being actuated once in an hour to present a new surface, the signal of which corresponds to the hour just begun, and the second multiple signaling device having signaling surfaces corresponding to each minute, and being moved once a minute to present the surface corresponding to the minute which will be next arrived at. The said signaling devices are actuated by electro-magnets, the circuits of which are controlled by a standard clock, and the contact springs or devices co-operating with the said multiple signaling surfaces to produce the desired signals are actuated by motors the circuits of which are also controlled by the said clock, and which are so arranged that the last stroke or electrical impulse of the minute signal will take place exactly in the minute.

Telephone; H. R. Miller, Baltimore, Md. 310,068

The mouthpiece of the transmitter is provided with a cover for the purpose of keeping out the dust when not in use.

Telephone Transmitter; J. H. Rogers, Washington, D. C..... 310,151

Consists in the application of a hinged rod electrode and a button-shaped electrode, the former resting upon the latter by gravity, and the latter upon the diaphragm,